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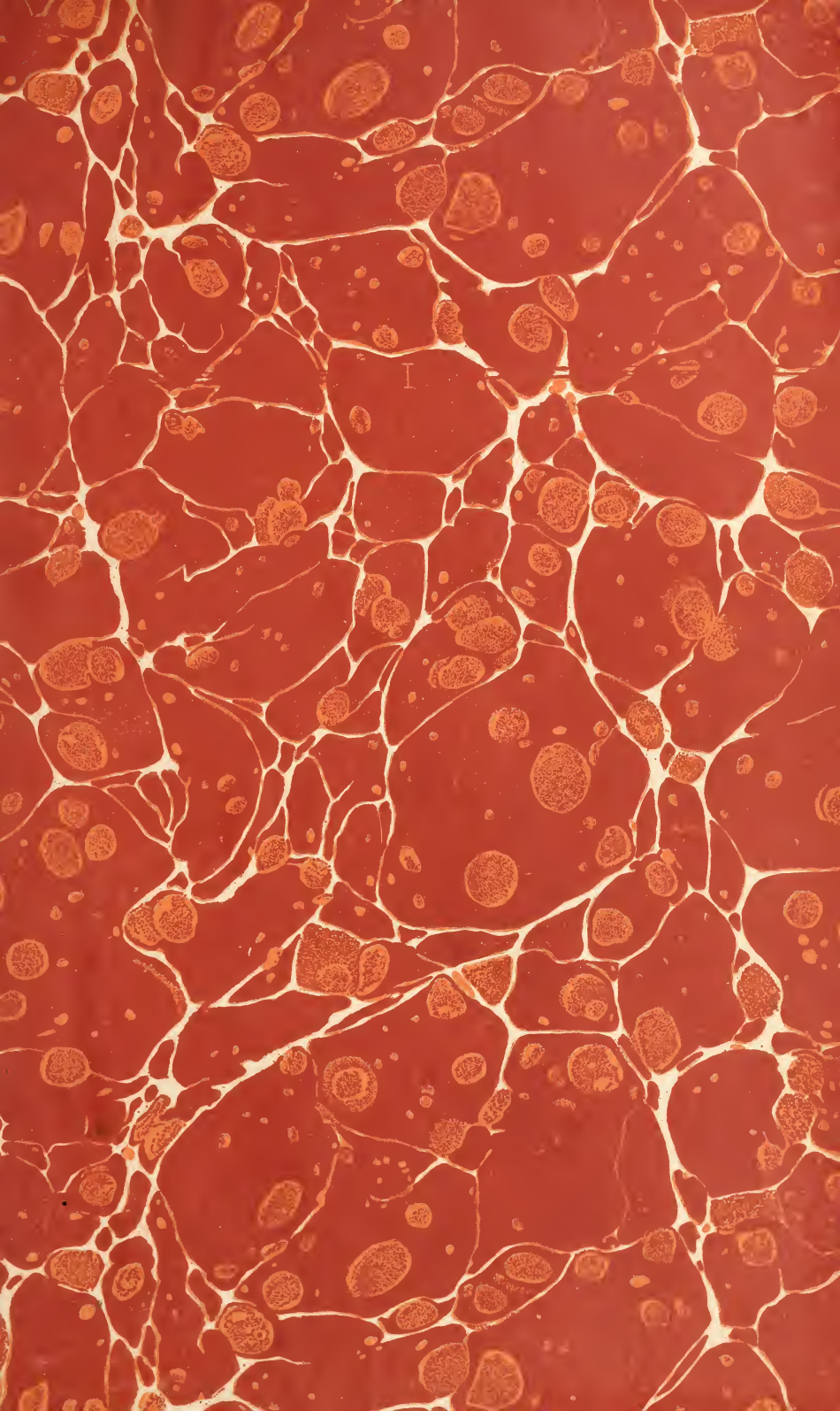
UNITED STATES
DEPARTMENT OF AGRICULTURE

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U. S. DEPARTMENT OF AGRICULTURE

WORK AND EXPENDITURES OF THE
AGRICULTURAL EXPERIMENT STATIONS
1917

PART I OF REPORT ON EXPERIMENT STATIONS AND
EXTENSION WORK IN THE UNITED STATES, 1917



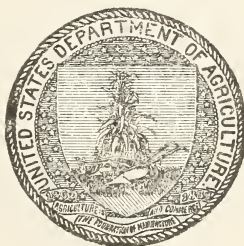
WASHINGTON
GOVERNMENT PRINTING OFFICE
1918

U. S. DEPARTMENT OF AGRICULTURE

WORK AND EXPENDITURES OF THE
AGRICULTURAL EXPERIMENT STATIONS
1917



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EXTENSION WORK IN THE UNITED STATES, 1917



WASHINGTON
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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
STATES RELATIONS SERVICE,
Washington, D. C., July 16, 1918.

SIR: I have the honor to transmit herewith a report on the agricultural experiment stations in the United States for the fiscal year ended June 30, 1917, and on the work of the Department of Agriculture in relation thereto. This report has been prepared in accordance with the following provision of the act of Congress of March 4, 1915, entitled "An act making appropriations for the Department of Agriculture for the fiscal year ending June thirtieth, nineteen hundred and sixteen":

That hereafter there be prepared by the Department of Agriculture an annual report on the work and expenditures of the agricultural experiment stations established under the act of Congress of March second, eighteen hundred and eighty-seven (Twenty-fourth Statutes at Large, page four hundred and forty), on the work and expenditures of the Department of Agriculture in connection therewith, and on the cooperative agricultural extension work and expenditures of the Department of Agriculture and of agricultural colleges under the act of May eighth, nineteen hundred and fourteen, entitled "An act to provide for cooperative agricultural extension work between the agricultural colleges in the several States receiving the benefits of an act of Congress approved July second, eighteen hundred and sixty-two, and of acts supplementary thereto, and the United States Department of Agriculture"; and that there be printed annually eight thousand copies of said report, of which one thousand copies shall be for the use of the Senate, two thousand copies for the use of the House of Representatives, and five thousand copies for the use of the Department of Agriculture (38 Stat. L., p. 1110).

This report embodies all the information heretofore submitted in compliance with the provisions of 34 Stat. L., p. 64, sec. 5.

Very respectfully,

A. C. TRUE, *Director.*

Hon. D. F. HOUSTON,
Secretary of Agriculture.



STATES RELATIONS SERVICE.

A. C. TRUE, Director.

OFFICE OF EXPERIMENT STATIONS.

E. W. ALLEN, Chief.

RELATIONS WITH INSTITUTIONS FOR AGRICULTURAL RESEARCH.

Supervision of Work and Expenditures of the State Experiment Stations under
Federal Appropriations.

E. W. ALLEN.

E. R. FLINT.

J. I. SCHULTE.

W. H. EVANS.

W. H. BEAL.

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Guam Experiment Station.

C. W. EDWARDS, B. S., Animal husbandman in charge, Island of Guam.
GLEN BRIGGS, B. S., Agronomist.
PETER NELSON, Assistant.

Hawaii Experiment Station.

J. M. WESTGATE, M. S., Agronomist in charge, Honolulu.
J. E. HIGGINS, B. A., M. S. A., Horticulturist.
F. G. KRAUSS, Superintendent of extension work, Haiku.
M. O. JOHNSON, M. S., Chemist.
C. W. CARPENTER, M. S., Plant pathologist.
J. B. THOMPSON,¹ B. S., Assistant agronomist.
C. A. SAHR, Assistant agronomist.
ALICE R. THOMPSON,¹ B. S., M. A., Assistant chemist.
J. H. COWAN, Assistant in horticulture.
R. A. GOFF, In charge of Glenwood Substation.

Porto Rico Experiment Station.

D. W. MAY, M. Agr., Agronomist in charge, Mayaguez.
P. L. GILE, A. B., Chemist.
C. F. KINMAN, B. S., Horticulturist.
R. H. VAN ZWALUWENBURG, B. S., Entomologist.
E. W. BRANDES,¹ M. S., Plant pathologist.
T. B. McCLELLAND, A. B., Assistant horticulturist.
J. O. CARRERO, B. S. Ch. E., Assistant chemist.
H. E. THOMAS, M. S., Assistant plant pathologist.
W. P. SNYDER, B. S., Assistant in plant breeding.
H. C. HENRICKSEN, B. Agr., Assistant in extension work, San Juan.
W. A. MACE, B. A., Assistant in extension work.

¹ On leave.

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WORK AND EXPENDITURES OF THE AGRICULTURAL EXPERIMENT STATIONS, 1917.

By E. W. ALLEN, E. R. FLINT, and J. I. SCHULTE.

RELATIONS OF THE OFFICE OF EXPERIMENT STATIONS WITH THE AGRICULTURAL EXPERIMENT STATIONS.

The same intimate and cordial relations between the Office of Experiment Stations and the agricultural experiment stations of the country continued as in previous years. An examination of the work under way and the use made of the Federal funds was made at each of the experiment stations, on the basis of a personal visit of the chief of the office or his associates, and the financial report was passed upon and approved at the close of the year.

As in previous years, the Adams fund was expended on the basis of projects for investigations, examined and approved by the office in advance of their inauguration; and the annual programs of work and expenditures for this fund were passed upon at the beginning of the fiscal year, before the stations were certified to the Treasury to receive the new appropriations. A large proportion of the stations have now placed all their work under the Hatch fund upon the project basis, which serves as a convenient means for administration and for following up the work and expenditures, and in many instances the larger projects on this fund are presented to the office for approval before they are taken up. This plan has been followed at some of the stations as a safeguard and as a means of securing the judgment and assistance of the office in inaugurating new projects.

As in previous years, the office has given considerable attention to helping the stations to secure men of adequate qualifications for their work. The many changes in the stations during the fiscal year made the calls in this line unusually numerous. This was especially true after the entry of the United States into the world conflict. Unusual efforts were therefore made to compile lists of persons available for station work and to gather information regarding their training, experience, and general qualifications. There were many expressions of appreciation of this service in bringing men and institutions together.

The multiplicity of demands made upon the directors, whose office is frequently combined with that of dean of the college of agriculture,

has resulted to some extent in a decreased attention to administrative details of the station activities. This is reflected at times in the items of expenditure assigned to the Federal funds, the contact maintained with the lines of work in progress, and the scrutiny of new undertakings. The fact that the colleges now have revenues from a multiplicity of sources and are engaged in so many different lines of effort makes some difficulty in an appropriate division of the expenses among the separate funds.

In some cases the same facilities and, to some extent, the same materials are used by various departments of the college and station work, and general overhead expenses, such as heating, janitor service, care of grounds, etc., apply equally to these different departments of the college. The proper adjustment of these expenses requires attention on the part of the administrative officers and can not be left to the accountants. Fortunately, to an increasing extent these general overhead expenses of the whole institution are being borne by the general maintenance funds of the college, thus avoiding complications.

Although the various departments of the station are usually headed by persons wholly competent to determine upon and plan the lines of study to be pursued, it is important for each station to have a well-thought-out policy of work, adapted to meeting the more important demands in the State. While the amount of administration called for is less than formerly, the importance of close contact and familiarity with the progress of the station in all its departments, in order to keep the work running smoothly, to understand the financial need and to present it to the people is quite as evident as it ever was, and especially since entering the war there are many questions to be determined by the administrative officer. The office has therefore continued to urge adequate provision for administration of the station's efforts, for study of the situation in the States with reference to the needs of inquiry, and making plans for the future of these institutions.

The close relations maintained between the office and the experiment stations of the country through official visits to them, through extensive correspondence, and through the medium of *Experiment Station Record*, have promoted relations of confidence and understanding and aided the discharge of the functions of the office in respect to this national group of institutions.

THE EXPERIMENT STATIONS AND THE WAR.

The experiment stations, like all other agricultural institutions, felt the influence of war conditions during the year, and especially after the entry of the United States into the conflict. Officers of the stations have taken conspicuous part in connection with the program

for increased production and for the conservation of food supplies to meet the burden which the war in Europe had placed upon the agriculture of this country. With the entry of the country into the war the executive force particularly was called into service in organizing the new lines of activities in the States, and in many instances headed these movements and their administration. The directors of the stations, for example, served on the State councils of defense, in several instances as chairman, at the head of production committees, as State food controller, and in similar capacities.

In general, there was an almost uniform turning to the colleges and stations for leadership in the States. This was met promptly and efficiently and in a most hearty spirit of service. The strength of the national system which had been building in the past 50 years, and especially in the past 25, and the great resource it now constituted to the Nation, became realized as never before.

War needs and war demands naturally interfered to some extent with the established routine of station work, but less so, possibly, than might have been anticipated. Productive research is a product of time and new facts can not be quickly developed to order, no matter how imperative the necessity. The stations have always worked in close contact with agricultural conditions and practice, and hence they had accumulated a broad basis of facts and information, which was almost immediately available and in a large measure was suited to meet the special demands. This fund, the product of some 30 years of patient study, with an ever-broadening vision into fundamental reasons and understanding, constituted a highly important element in agricultural preparedness, largely mobilized and ready for spread and application by the new army of agricultural extension.

It is easy to conceive how different would have been the situation and how seriously handicapped the undertaking a quarter of a century ago. The occasion has been a time of great harvest of station results and their translation into practice. Applications of station teachings have been effected which in character and extent would normally have required many years, often a generation, to accomplish. Inquiry is rarely made as to the source of the new things which are being taught and applied under stress of circumstances, and this source may often not be known, but in very large measure it is found in experiment and investigation which have pointed the way and made the course sure.

While the new conditions had the effect of turning attention more sharply to the immediate problems of production, few of the station projects have been seriously interrupted or abandoned. This has not been found necessary or deemed advisable, because a way has usually been found to keep them alive and their permanent value and importance, in reconstruction if not during the war, have made con-

tinuance seem highly desirable. To a considerable extent the most important work of the stations is a continuance of the working out of fundamentals and the reducing of theory to practice, all of which must be done in advance. In other words, the stations must, to a very large extent, keep well in advance of the needs of the day and lay deep and secure the foundations of the theory and the practice of agriculture.

There has, however, been a considerable adaptation of the programs of work of the stations to better meet immediate needs, and especially to enable taking up experiments on practical questions which need immediate attention. Special scrutiny has been given to new projects as to their promise of early returns, preference being given to those which will have a practical bearing as compared with those which deal more remotely with practical applications, for the time being aiming at the development of theory. The solution of questions of vital importance in bringing about a readjustment of agriculture to meet changing conditions and the needs of the Nation has been an uppermost thought in shaping the lines of current and future station activity.

While care has been exercised in all cases to preserve the organization and purpose of the stations and to keep alive the research work whose immediate and prospective value has been given such convincing demonstration, the difficulties of the stations have been enhanced by the loss of men who have entered the military service or gone over into other lines of technical and industrial employment. This is inevitable and will doubtless increase as the war continues. The difficulty of filling their places has been increasingly serious. It will make it necessary to husband the energies of those who remain and to direct them with unusual care into lines of present and prospective needs, subordinating other inquiry for the time being. The situation calls for the exercise of clear judgment and foresight, based on a study of practical and economic conditions and a consideration of the means at hand and available. It involves working close to the ground and in unusually close contact with the farming industry, and in helpful, cooperative relations with those who are directly engaged in aiding and stimulating the farmers.

The relations with the extension departments of the colleges offer unusual opportunities in this connection. These relations should be especially close at this time and should aim at assisting these workers who are carrying the word to the farmer and attempting to aid and advise them in so many different lines. In addition to supplying these workers with reliable information in available form they may be given assistance in meeting the questions which come to them in their daily rounds, and which, although often relatively simple and possibly of temporary interest, become important because of the

economic conditions and the necessity of making every effort as efficient, sure, and productive as possible. The working out of the ways and means is the field of the stations, and it leads the experts out into the field where the problems lie. At such a time no question is too simple to warrant their attention.

The situation offers unusual opportunity and incentive for cooperation among stations. Their results need to be checked up where there is disagreement or where there are differences in local conditions. By cooperative effort time may be saved and security added to the conclusions. Council among workers to determine the exact status of subjects under experiment, methods employed, and the reason for differences in results, are profitable as a step in planning further experiments. In this way fragmentary, incomplete, and inconclusive or misleading results may be avoided. A division of effort or an understanding regarding experiments along a common plan is a profitable means of "speeding up" results that are broad and conclusive.

FUNDS AND EQUIPMENT.

The experiment stations, including the stations in Alaska, Hawaii, Porto Rico, and Guam, were supported during the fiscal year ended June 30, 1917, by a total revenue of \$5,642,149.16, representing an increase of \$308,075.23 over the revenue of the preceding year. This financial support comprised \$1,580,102.04 received from Federal appropriations, \$2,322,335.65 from State and Territorial allowances, and \$1,739,711.47 from fees, sales of products, and other sources of income. The Federal appropriations constituted about 28 per cent of the total station revenues, while the State and Territorial funds amounted to about 41 per cent. The funds derived from the Federal and the State and Territorial appropriations showed a small increase over the amounts received the year before, while the receipts from fees, sales, and other miscellaneous sources were greater by about \$250,000 than those reported for the preceding fiscal year. The value of the additions to station equipment for the past fiscal year was given at \$751,198.33.

The State support for the stations was more than maintained during the past year and there were only five stations receiving no financial aid from the State, this being the smallest number without State aid in the history of the experiment stations in this country. The amounts allowed by the States showed considerable latitude, and while progress was reported at every station, the greatest advances were made by the more liberally supported institutions. The State appropriation is now the chief source of income of about one-half the number of stations, and in nearly three-fourths of this number the Federal funds are more than offset by the receipts from the State,

together with those from other sources. The leading stations as to total revenues and the amounts at their disposal during the past year were the following: Indiana, \$408,596.32; Ohio, \$383,882.26; Illinois, \$296,525.94; Kentucky, \$256,842.26; California, \$238,578.09; Minnesota, \$238,319.81; Texas, \$194,809.23; and Iowa, \$185,280.18. In addition to these mentioned, 11 stations received each more than \$100,000 to defray the expenses of operation and equipment.

Among other important State appropriations to the stations, together with the establishment of substations and increases in lands, buildings, and other equipment, the following are worthy of note:

The Arizona station began the operation of a new substation located near Mesa in the Salt River Valley. This substation, with its 160 acres of land, will constitute the main point for experimental work in the irrigated part of the State and will be devoted to experiments in horticulture, agriculture, and animal husbandry.

In Arkansas a substation was established on a 40-acre tract at Scotts and a sum of \$4,000 for the biennium was allowed by the State for its maintenance.

The California station received direct appropriations amounting to \$140,000 for the construction of a creamery and an animal husbandry building, for the provision of a water supply, and for making repairs at the station farm at Davis. The buildings planned a year ago at the citrus experiment station at Riverside were completed and an allowance of \$50,000 was made for extensions.

The Colorado Legislature provided for a millage tax from which the experiment station will receive from \$45,000 to \$50,000 annually. The State also appropriated to the station \$5,000 for a drainage project at Grand Junction, \$1,500 for an investigation of the utilization of fruit juices, and \$10,500 for cooperative work with the United States Department of Agriculture in horse breeding, irrigation investigations, and alfalfa-seed production.

The Connecticut State station received from the general assembly an appropriation of \$28,000 for the construction of a central heating plant and an addition of \$2,500 per year to the maintenance appropriations of the station. Among other allowances in which the station is interested more or less directly are \$40,000 for the suppression of brown-tail and gipsy moths and nursery inspectors, \$1,500 for the study of bee diseases, \$10,000 for the elimination of mosquito breeding, \$1,500 for the control of white-pine blister rust, and \$5,000 for the purchase of forest land.

The Florida Legislature made provision for the establishment of a substation at or near Winterhaven for the study of insect pests, diseases, and other agencies affecting citrus fruits.

The biennium appropriations made by the State of Idaho for the benefit of the experiment station included \$4,000 for the further

study of insect pests troublesome to alfalfa and clover-seed producers, \$1,200 for emergency calls in the investigation of plant diseases, insect pests, and soil troubles, \$1,200 for soil-survey work in cooperation with the Bureau of Soils of the United States Department of Agriculture, \$4,500 for the erection of additional greenhouses, and \$2,500 for tile draining and fencing. The State board of education authorized the use of \$25,000 for the erection of a new horse barn, hog and sheep barns, and a seed house. The segregation of 160 acres of State lands was authorized for use in a study of problems concerned with high-altitude agriculture, a substation is to be established in a region whose altitude is 6,000 feet or more, and an appropriation of \$3,500 for the biennium was made for this purpose, and it was provided that the citizens of the community in which the station is to be located are obligated to raise a like amount for the erection of buildings. The State appropriation for the Aberdeen substation was \$5,000, the Caldwell substation \$7,800, and for the Sandpoint substation \$5,000.

The Iowa station completed an animal husbandry laboratory costing about \$60,000 and devised specially for work in connection with slaughtering, dressing, cutting, and curing of meats; the purchase of a farm for animal husbandry work to cost about \$75,000 was authorized, and \$10,000 was appropriated for the purchase of an orchard for pomological work. For the State soil survey \$50,000 was available.

The State appropriation for the Kansas station included \$80,000 for the acquirement of land for animal husbandry, dairy, and poultry farms. An allowance of \$50,000 was made for an addition to the agricultural building.

The Maryland college had under construction a new agricultural building, for which the State legislature appropriated \$175,000. The building is to be devoted in part to experimental work and other station purposes.

The Legislature of Massachusetts appropriated \$10,000 for the maintenance and improvement of the market-garden substation at Lexington.

The Montana station will be benefited by the construction of buildings under a State appropriation of \$175,000 to be used in part for the replacement of the chemistry building destroyed by fire. The State board of health made an allowance of \$5,000 to the entomological department for the study of the spotted-fever tick, the horsefly, and the mosquito.

The Nebraska station with a State appropriation of \$32,000 for the purpose purchased a 160-acre farm for agronomy work and with an appropriation of \$10,000 acquired an 80-acre farm near Union for fruit-demonstration work. The State also made an appropriation of \$10,000 for the study of animal diseases. Under an act of Congress

signed March 3, 1917, the Secretary of the Interior is authorized to transfer to the University of Nebraska for use in dry-land experiments a tract of about 800 acres of public land adjoining the Scotts Bluff substation.

The New Mexico Legislature increased the State appropriation to the experiment station by \$2,500 per year.

In Ohio two county experiment farms, one of 170 acres in Belmont County, and one of 166 acres in Madison County, were established during the year, making a total of 10 such farms now in operation in this State. In addition the station supervises three district farms and two forest tracts, making nearly 4,500 acres under its direction in work over the State.

The Oregon college was provided with State funds for the construction of a veterinary building and a horticultural products building, each to be devoted in part to experimental work. The dairy barn was remodeled at a cost of \$3,000 and an allowance of \$5,000 was made for a hog barn.

Among the appropriations made by the Legislature of South Dakota the station is interested in an appropriation of \$100,000 for the completion of Agricultural Hall, \$10,000 for the manufacture of hog-cholera serum, \$10,000 for the purchase of pure-bred live stock, \$3,000 for the establishment of a poultry department, and \$5,000 for feeding experiments with farm animals. The State also allowed the station \$2,000 per annum for two years for the study of hardy alfalfas.

The State of Tennessee provided about \$100,000 for the construction of buildings at a substation in middle Tennessee to be located on land provided by the county securing the institution.

The State of Texas appropriated for the station and substations a sum of \$225,095.34 for the year beginning September 1, 1917, and \$181,270.40 for the following year.

The State of Utah increased the appropriation to the station by \$7,500, and granted in addition \$61,100 for buildings and improvements and \$6,000 for pure-bred live stock and pasture.

The Legislature of West Virginia in 1917 granted an additional \$75,000 for the completion of the agricultural building and appropriated \$20,000 for buildings on the new farms and \$10,000 to meet increases in operating expenses and the high prices of apparatus, chemicals, and other materials. The station by bequest received an estate of about 930 acres of improved land and a herd of about 125 pure-bred Ayrshire cattle, the total value being approximately \$121,000. The land is well equipped with buildings, farm machinery, etc., and includes a recently constructed cheese factory. The purpose of the gift is "the promotion, development, and advancement of the science of agriculture in its most comprehensive scope and, in ad-

dition, special attention to the breeding and development of Ayrshire cattle." The station obtained possession March 1, 1917.

PERSONNEL.

The numerous changes in the personnel of the stations occurring during the year were largely the result of war conditions and in many cases were brought about by the entry of station men into the Army either under the draft law or as volunteers. Changes in the directorship occurred at a number of these institutions. R. J. H. De Loach, director of the Georgia station, was succeeded by J. D. Price; J. N. Harper, of the South Carolina station, by H. W. Barre; and I. D. Cardiff, of the Washington station, by George Severance as acting director. Arthur Goss resigned the directorship of the Indiana station to take effect September 1, 1917, and A. F. Woods resigned as director of the Minnesota station to enter upon the presidency of the Maryland College of Agriculture, July 1, 1917. C. G. Williams, agronomist of the Ohio station, was appointed also associate director.

In addition to the change in the presidency of the Maryland college, changes occurred in that office also in a number of other colleges and universities with which stations are connected. G. E. Ladd, of New Mexico, was succeeded by A. D. Crile; M. A. Brannon, of Idaho, by E. H. Lindley; and A. W. Hendrick, of Nevada, after the close of the year, by W. E. Clark. W. C. Riddick assumed the presidency of the North Carolina college, and after the end of the fiscal year F. L. McVey entered upon the presidency of the University of Kentucky; W. M. Jardine, of the Kansas college, and R. D. Hetzel, of the New Hampshire college.

Among other more important changes in the station staffs, involving mainly positions as heads of departments, the following may be mentioned: P. B. Barker was appointed agronomist and J. A. Elliott, as successor to J. L. Hewitt, plant pathologist of the Arkansas station. G. C. Starcher succeeded E. Walker as horticulturist of the Alabama station, and H. Embleton succeeded B. A. Ahrens as poultryman of the Oklahoma station. F. H. Smith was appointed chemist of the Georgia station, M. C. Merrill horticulturist of the Utah station, and W. A. Gardner botanist of the Alabama station. P. M. Brandt became dairy husbandman and A. L. Lovett entomologist of the Oregon station. A. C. Baer was placed in charge of the dairy department of the Oklahoma station, R. L. Hill was appointed biochemist in dairy research at the Maryland station, and C. W. Carpenter assumed the position of plant pathologist at the Hawaii Federal station.

F. Rasmussen succeeded C. W. Larson as dairyman and S. W. Fletcher succeeded M. G. Kains as horticulturist of the Pennsylvania

station. F. W. Christensen, nutrition chemist of the New Mexico station, was succeeded by J. D. Hungerford, and G. M. Turpin, poultryman of the Iowa station, by H. A. Bittenbender. C. B. Hutchison resigned as head of the farm-crops department of the Missouri station, I. S. Cook as agronomist, and F. E. Bear as head of the soils department of the West Virginia station, and C. B. Lee as animal husbandman of the Nebraska station. Other resignations included those of E. G. Titus as entomologist of the Utah station, T. P. Haslan as animal pathologist, and F. S. Schoenleber as head of the veterinary department of the Kansas station, R. C. Reed as animal pathologist of the Delaware station, and N. Schmitz as agronomist of the Maryland station. V. M. Shoesmith withdrew from the position of farm-crop experimentalist of the Michigan station, E. V. McCollum from the position of agricultural chemist of the Wisconsin station, and O. F. Hunziker from the headship of the dairy department of the Indiana station. E. M. R. Lamkey was placed at the head of the newly organized division of plant physiology of the Delaware station, F. S. Holmes in charge of stone-fruit investigations at the Maryland station was succeeded by E. S. Johnston. W. J. Carson resigned as dairy husbandman and F. C. Minkler as animal husbandman of the New Jersey stations, and R. R. Graves as dairyman of the Oregon station.

A. V. Stubenrauch, professor of pomology at the University of California and pomologist of the experiment station, died February 12, 1917, after a short illness. Prof. Stubenrauch was born in Louisiana in 1871 and studied in the preparatory department of Tulane University, New Orleans. He was graduated in 1899 from the college of agriculture of the University of California and in 1901 took a master's degree in agriculture at Cornell. He was for a time secretary to the late E. W. Hilgard, then director of the University of California experiment station and dean of the college of agriculture. Prof. Stubenrauch was instructor in horticulture in the University of Illinois and assistant horticulturist of the experiment station in 1901, and from 1902 to 1905 assistant professor of horticulture and assistant horticulturist of the experiment station at the University of California. From 1906 to 1914 he was connected with the Bureau of Plant Industry of the United States Department of Agriculture, at first engaged in the study of problems related to fruit transportation and storage, then in charge of the Office of Field Investigations in Pomology, and finally in charge of the Office of Horticultural and Pomological Investigations. He severed his connection with the department in 1914 to accept the professorship of pomology at the University of California, which he held up to the time of his death.

Dr. J. T. Anderson, professor of chemistry at the Alabama college and chemist for soil and crop investigations at the experiment sta-

tion, died February 25, 1917, at the age of 67 years. During a period of service of 29 years at the institution much of his station work was in connection with the fertilizer inspection, but he also studied for a long time the nutrition of the cotton plant, giving particular attention to the determination of the fertilizer requirements of the soil by analysis of the cotton plant grown. He also studied the factor affecting the application and insecticidal efficiency of arsenicals. Dr. Anderson was also one of the early workers in the Association of Official Agricultural Chemists.

SOME RESULTS OF STATION WORK.

The work of the stations for the year has been influenced to a considerable extent by the situation resulting from the entry of the country into war. While the main lines of investigations were not dropped as a rule, those phases of the work which had a more direct bearing on food production and conservation were emphasized, and the results given as wide publicity as possible.

A brief summary of some of the results is given here, which will indicate the wide field of research carried on by the stations.

AGRONOMIC INVESTIGATIONS.

In studies made at the Idaho station on the fertilization of wheat, no increase of yield was obtained with potash and phosphoric acid, while nitrate of soda gave an increase of 5 to 10 bushels per acre. Liming on cut-over land had no apparent effect on the grain yield. Studies at the Kansas station showed that if weeds are allowed to grow in wheat fields in the summer, there is a waste of available moisture and the accumulation of nitrates is prevented. Soil on which wheat had been grown continuously at the North Dakota station contained one-fourth less nitrogen than virgin soils. The critical period for this crop in regard to soil moisture was found to be 10 to 20 days before heading, at the Colorado station. A strain of Kharkov wheat was isolated at the Montana station that yielded 10 bushels more per acre than the original variety.

Soy beans have been studied by various stations. At Ohio selected strains were obtained, yielding 28 to 29 bushels per acre, and a yield of 30 bushels of beans and 2 tons of cured hay per acre was secured at the Iowa station. In Nebraska it would only mature in favorable seasons. Liming at the New Jersey station resulted in a greater number of nodules, and both the beans and stalks were richer in nitrogen.

Experiments with corn at the Virginia station showed that an abundant supply of moisture in the early part of the growing season was more important than at the time of tasseling, when it appeared

to delay maturity. Small kernels produced ears that matured two or three days earlier than the average. Culture experiments gave the best results from three cultivations. The Illinois station recommends shallow rather than deep cultivation, the object being the eradication of weeds. Heavy applications of fertilizer in the row at the Missouri station was apt to injure the crop; best results were obtained by drilling the fertilizer ahead of the planting or at the second cultivation. At the Georgia station fertilizers put around corn after it was up gave 13.4 per cent increase over that put on at the time of planting. The New Jersey station reports larger yields when nitrogen was supplied in the form of green manure than with chemical fertilizers. Velvet beans planted with corn at the Georgia station greatly reduced the yield of corn, but the total yield of nutrients was increased. At the North Dakota station the use of manure and phosphoric acid on corn, oats, and barley did not give sufficient increase in yield to cover the cost of the fertilizer. Papago sweet corn proved to be excellent for silage at the Arizona station.

Close grazing of pastures was better than light grazing, and it was found profitable to fertilize with phosphoric acid and top-dress with lime at the Virginia station. A comparison of the effect of grazing on pasture grasses at the New York Cornell station showed that blue grass did not decline, but timothy, redbud, and rye grasses did. At the Guam station Para and Paspalum were found to be excellent as soiling crops and for permanent pasture, but the latter will not stand heavy grazing until well established. Sudan grass also proved to be a good soiling crop.

At the Illinois station the greatest practical farm problem was the maintenance of organic matter and nitrogen. Phosphorus was found to be deficient in the soils of the State. The Minnesota station reports that all of the peat soils examined were deficient in phosphorus but usually had sufficient lime and potash. At the Ohio station sodium nitrate was found to be profitable only on the most exhausted soils. Under present conditions there was found to be no profit in the use of potash fertilizers and only a narrow one with nitrogen, emphasizing the necessity of the farmer being independent of purchased nitrogen and potash in maintaining the fertility of his fields by manure and green crops. Potash on corn and oats at the South Carolina station did not give enough returns to pay. In the Piedmont region it appeared to injure cotton. At the Texas station commercial fertilizers were only found to be profitable when rotation or other means of increasing the organic content of the soil was practiced. Negative results were obtained with commercial fertilizers in Wyoming, except those containing nitrogen. After 35 years of a five-year rotation at the Pennsylvania station, where no fertilizers were applied, the fertility has decreased 40 per cent. Phosphoric

acid was the limiting factor. Potash alone gave no marked increase. Sodium nitrate proved to be the best form of nitrogen for extended periods. The plats are gradually becoming more acid.

Soils where lime has been applied for several years, at the Rhode Island station, are still acid. Most crops appear to do as well on slightly acid soils and complete neutralization does not seem to be necessary. Beans were found to thrive equally as well on either acid or alkaline soils. Beets and onions did best where lime was applied. At the Mississippi station the effects of the application of native lime rock was noticeable in increased yield of clover after three years.

Sweet potatoes at the Tennessee station stored in 25-bushel bins with double walls, 10 inches apart, filled with sawdust, kept 12 months in good condition. The Maryland station finds that if the carbon dioxid arising from the respiration of stored Irish potatoes is removed by ventilation, the equilibrium of the carbohydrates maintained in the tuber is not disturbed and the storage conditions are much improved.

Northern grown Irish potato seed, at the Tennessee station, gave earlier maturity, but home-grown seed gave higher yields. The Utah station finds that potatoes require an even moisture content of the soil throughout growth, sugar beets being more sensitive during the middle period of growth, and oats during the early period. At the Idaho station the yield of potatoes was increased 25 bushels per acre by the application of nitrate of soda. The Maryland station reports that the buds near the cut surface of seed potatoes are the first to sprout. Buds on parings one-fourth inch thick produced good plants. Thinner parings did not.

Cotton was the only crop that gave financial returns from plowing to a depth of 12 inches in Texas. Subsoiling in Mississippi gave no increase in yield of crops, but deep plowing, 8 to 10 inches, was better than 4 inches.

At the Nebraska station alfalfa produced better silage if it was sprinkled with lactic-acid cultures as it was put into the silo. Alfalfa and sweet clover silage spoiled when the dry matter was less than 25 per cent at the Iowa station. The Missouri station finds that good silage can be made from legumes if they are first wilted in the field. At the California station the optimum irrigation requirement for alfalfa was 30 inches. At least 18 inches of rainfall was required for a good crop. The amount of water required per pound of dry matter increased with the age of the plant. Results at the Kansas station showed that the more nearly mature alfalfa is at the time of cutting the less injury there is to permanence of stand.

Through the improvement and extension of culture of the Tepary bean by the Arizona station a valuable addition has been made to the agriculture of the Southwest. The station has also introduced

the spineless saba prickly pear, which is hardy, drought resistant, and promises well. The Oklahoma station is developing a fine-stemmed early strain of Sudan grass which promises to be excellent for hay. Selection experiments at the Tennessee station have produced two distinct types of Lespedeza, a high bushy hay type and a low grazing form.

At the Arizona station the eradication of Johnson grass by the bare fallow method cost \$30 per acre the first year and \$15 the second. At the Louisiana station this grass was nearly killed out after four years by the Kudzu bean. Spraying with sodium arsenite successfully eradicated salt sage and blue lettuce, but not the Canada thistle, at the Montana station.

The New York Cornell station finds that when the nodule-forming organisms of peas are transferred to vetch, nodules are formed but with no fixation of nitrogen.

Giant sunflower was successfully grown for silage at the Montana station, yielding 39.8 tons per acre. Three and a half pounds of this proved equal in feeding value to 1 pound of alfalfa. Similar success with this crop is reported by the Wyoming station. The Russian thistle was tried for silage at the New Mexico station without success.

At the Mississippi station horse manure compared with oats and vetch turned under showed results in favor of the latter, ton for ton. At the Rhode Island station after effects on the hay crop showed no difference when the same amount of money was invested in raw rock or acid phosphate. At the New Jersey station sodium nitrate gave the highest recovery of nitrogen in the crop from that applied, being 55.77 per cent in the field and 61 per cent in pot experiments. In compost mixtures of sulphur and rock phosphate, 85 per cent of the latter was rendered soluble in 30 weeks. In some selected soils this was accomplished in 12 weeks. The presence of iron and aluminum sulphates hastened the oxidation of the sulphur, while nitrates apparently stopped the action. Microorganisms seemed to start the process and then die off. The action appeared to be enzymic.

At the Kansas station it was found that from 20 to 25 per cent of Kafir corn meal could be mixed with wheat flour and give good bread. The Wisconsin station reports barley flour to be a good substitute for a portion of the wheat flour in bread.

ANIMAL HUSBANDRY.

At the Ohio station studies of the mineral requirements of milk production show that not enough lime, magnesia, and phosphorus are digested from most feeds to maintain a liberal milk flow. At the Virginia station cows fed a high protein and low energy ration kept in fine condition and digested an excess of the protein required for maintenance and milk production. Those on a low protein and

high energy ration became extremely emaciated and the coefficients of digestibility of all nutrients was much reduced. The Wisconsin station finds wheat to be lacking in certain ash constituents and in protein, and to contain mildly toxic principles that proved injurious if fed excessively. Corn was found to be a better-balanced ration. Clover and alfalfa were excellent for balancing these grain feeds. Various seeds alone in rations proved to be imperfectly balanced, being deficient in sodium and calcium salts. The addition of calcium carbonate to such feeds gave good results. Millet came the nearest to being a balanced ration. The leaf and seed from the same plant in many cases gave a balanced ration. Most of the feeds studied were found to be deficient in fat soluble A.

Two pounds of velvet-bean meal was equal to 1 pound of cottonseed meal in producing capacity for dairy cows, and $2\frac{1}{2}$ pounds to 1 pound for fattening steers, at the Alabama station. Comparing palm-kernel meal, wheat bran, and cottonseed meal for dairy cattle, cottonseed meal was best and bran the poorest. Feeding dairy cattle cottonseed meal, linseed meal, bran, and peanut meal, at the Virginia station, the first two gave the best and cheapest gains. At the South Carolina station velvet-bean meal compared with cottonseed meal for dairy cattle showed a slightly better milk flow from the latter, and the velvet-bean meal produced a softer, whiter butter. A comparison of oats and silage for milk production was in favor of grazing oats. The Missouri station finds that the most practical ration for dairy heifers is silage or legume hay for roughage, with about 2 pounds of grain daily. At the Georgia station cottonseed meal added to silage did not affect the digestion coefficient of either. Velvet-bean hulls were found to have little feeding value. Comparing outdoor and indoor housing for dairy cattle, at the Pennsylvania station, the outdoor group decreased in production during cold weather more rapidly than the indoor group but regained the normal sooner.

At the Ohio station pigs receiving all the corn they would eat made slower gains, on account of an unbalanced ration, than with a limited grain ration. The value of tankage as a substitute for corn in feeding hogs at the New Mexico station was shown by comparative experiments. Tankage gave more than twice as much gain at two-thirds of the cost. Velvet-bean meal did not prove a satisfactory feed for hogs at the Kentucky station. Hogging down soy beans was profitable if a supplementary feed of corn was given. Cowpeas were not profitable even with a supplementary feed. For hardening pigs fed on peanut pasture, at the Texas station, feeding milo maize and cottonseed meal for 30 days, or milo alone for 45 days was successful. Barley and oats did not return cost for growing pigs, while rape and kale gave satisfactory returns; at the Montana station 1 pound of

barley per 100 pounds for pigs on clover pasture gave the cheapest gains.

Alfalfa hay proved to be the best supplement to barley. At the Alabama station velvet-bean meal produced a firm white lard, but the carcasses were a little darker than the corn-fed hogs. The cheapest pork was raised on peanut forage, costing \$1.75 per 100 pounds of gain and selling for \$8.75 per 100 pounds. The South Carolina station reports that velvet-bean meal was better relished by hogs and gave better results than soy-bean meal. An experiment in feeding garbage to hogs at the California station showed that sodium carbonate, when mixed with the garbage, had no appreciable effect, but when fed alone 2 ounces usually proved fatal. At the Oregon station coconut meal was found good for maintenance but not for fattening hogs; whey did not prove satisfactory for fattening. A corn diet alone was found to be deficient in ash constituents and protein by the Kansas station. Hogs on alfalfa pasture did not eat enough concentrates to make a balanced ration. At the Arkansas station brood sows fed soy-bean hay and corn meal made the cheapest gains, but those receiving alfalfa hay and corn made the best pork. Self-fed swine made 100 pounds of gain at less cost, the daily gain was greater and the animals were more highly finished than by the usual method of feeding. Rice bran and rice by-products were found to have a tendency to produce a soft, oily pork.

In experiments at the Louisiana station 1 bushel of corn produced from 12 to 16 pounds of pork. Two and a half to three bushels of sweet potatoes were equivalent to 1 bushel of corn in feeding value. It was found at the Missouri station that self-fed pigs on rape forage required 384 pounds of feed to make 100 pounds of gain, while the hand-fed lot required only 365 pounds. Corn alone for hogs on rape forage was not a well-balanced concentrate. A combination of corn, shorts, and tankage, or corn and skim milk was better. Rape was superior to blue grass for pasturing hogs.

Simultaneous breeding of a Berkshire sow with a Berkshire and a Chester White boar at the Delaware station gave only pure black and pure white pigs, with no mixtures. The Wisconsin station considers hairless pigs to be due to nutritional causes. They were found to have an enlargement of the thyroid gland and a low iodine content.

A comparison of pasturing steers alone and with the addition of cottonseed meal, at the Virginia station, resulted in better results from the former; the animals receiving the meal did not graze as long or give as good returns. Experiments at the New Mexico station show that cowpea hay can take the place of cottonseed meal and that all feeds necessary for fattening range steers for beef on a properly balanced ration can be grown under dry-farming conditions. At the Texas station, comparing cottonseed meal with ground whole pressed

peanuts for fattening yearling steers, results were slightly in favor of the cottonseed meal, while in a similar test with 2-year-old steers, those receiving peanut meal did a little better. The Nebraska station finds that the protein of a ration can be supplied either in roughage or in concentrates. If a small amount of protein concentrate is to be fed, it should be given in the latter part of the feeding period. In fattening 2-year-old steers, the Iowa station found that the grain ration could be cut one-half to one-quarter, it being more profitable to feed 3 to 5 pounds daily than 15 to 20 pounds. Similar results were obtained at the Indiana station where a limited corn ration gave more economical gains than a full feed for fattening steers.

In Montana, wintering breeding beef cattle on straw with 5 pounds of hay per head gave good results. Steers were carried through the winter for \$7 at the North Dakota station. Steers on range, at the Wyoming station, gained 1 pound during the winter, while those fed at the station gained 168 pounds. A comparison of alfalfa hay and cottonseed meal as a source of protein, fed with corn silage supplemented with corn, showed the superiority of the cottonseed meal in producing a more rapid finish with steers at the Pennsylvania station. Feeding experiments with yearling beef animals, at the Kansas station, showed the most profit per steer, \$6.09, on a ration of shelled corn, oil meal, and sweet-clover hay. Steers were maintained for 60 days, practically, on Japanese clover alone at the Louisiana station. At the Mississippi station it was found that corn could be used profitably as part of the grain ration, with sorghum silage, for fattening steers, when selling at \$1 per bushel. A satisfactory grade of beef was produced at the Missouri station without corn. With corn silage, hay, and cottonseed meal a 3-year-old steer made a gain of 322 pounds in 130 days.

Trials with the self-feeder for cows at the Virginia station showed that they ate about twice as much as those with the grain weighed out to them and made no better returns. At the New Mexico station Sudan grass proved to be one of the best annuals for summer and fall pasture to supplement permanent pasture. The station recommends mesquite beans as feed for stock when grain is high. They have a feeding value comparable to barley. In a comparison of close confinement with open range at the Kentucky station, the confined lot made better and cheaper gains and sold for a better price.

At the Montana station $3\frac{1}{2}$ pounds of giant Russian sunflower silage was equal to 1 pound of alfalfa hay. Sunflower silage, clover, and corn were equally good as soiling crops. Stock wintered on dry feed and silage, at the Idaho station, came out in much better shape than those on dry feed alone. Straight wheat silage threw animals off feed. Three tons of corn silage at the Utah station, and 2 tons of pea silage at the Wyoming station, were equivalent to 1 ton of alfalfa hay.

The Nevada station reports that poisoning of stock on the range by forage plants could be much diminished by proper management, such as feeding a small supplement and allowing the animals time to choose their grazing. Burning over pastures in the spring, at the Kansas station, did not injure the grass as far as immediate effects were concerned. The burned areas warm up earlier, the grass starts quicker, and gives earlier pasturage. At the Mississippi station silage made from cotton stalks cut before the leaves fall was found to have a high feeding value.

Finishing calves on shelled corn, cottonseed meal, and silage, at the Illinois station, produced yearlings that brought the highest price in the Chicago market. The Missouri station finds that growing animals fed a low ration remain about 60 days behind those receiving a full ration in development. The liberal use of skim milk is important in growing calves during the first two or three months of life. At the Pennsylvania station the amount of milk necessary to produce 1 pound of gain in calves was 9.4 pounds. Weanling calves wintered on pasture grass, at the Mississippi station, made more gain than those on sorghum silage.

Many of the stations have been engaged in studies connected with the sheep industry. At the Illinois station a comparison of whole and ground grain for feeding lambs showed that it required 15 per cent less grain to produce the total gain when the grain was ground. In fattening lambs at the Nebraska station the largest profit and cheapest gain was secured from feeding corn, alfalfa, and silage; the next largest from a full corn ration. Range-fed ewes at the Montana station produced a weaker and inferior wool to those fed at the station. Lambs fed corn silage as the only roughage at the Indiana station did not make as economical gains as those fed dry roughage in addition. Alfalfa hay gave more rapid and economical gains than clover hay with lambs, and more economical gains were made when they were not sheared. At the North Carolina station no harmful effects were noticed in feeding large quantities of cottonseed meal to sheep. Lambs on a full ration were found to withstand the effects of the stomach worm better than those on pasture alone. The breeding flock at the Idaho station was maintained on pea-and-oat silage as the sole succulent. At the Oregon station one sheep required 0.48 acre of pasture and 0.3 acre of cultivated land. Six sheep were equivalent to one cow in the areas required. The Pennsylvania station reports a ration of alfalfa hay, corn silage, and a limited grain ration as satisfactory for breeding ewes.

Comparing Shropshire and Delaine Merino ewes at the Pennsylvania station, the former produced a higher percentage of lambs which were heavier, made more rapid growth, and matured earlier. The latter did better on pasture without supplementary feed, required less

grain, and cost less for maintenance. At the Kentucky station breeding mountain ewes with pure-bred rams increased the weight of fleece 3 pounds at the first cross. A cross of native and Siberian sheep at the South Dakota station has produced a hybrid with excellent wool, from which it is hoped to develop a strain that will not need docking. Sheep breeding at the Oklahoma station showed that the Shropshires transmitted the mutton conformation strongly, the Merinos and Rambouillets transmitting density and fineness of fleece.

It was found at the New Hampshire station that ewe's milk which will furnish the proper amount of protein and ash will supply sufficient fat to meet the requirements of growing lambs of suckling age. The quantitative supply of protein and ash is the limiting factor. Family performance was found to be a better basis for selection than individual traits.

The Colorado station has produced a uniform type of horse, weighing about 1,300 pounds, for light work and driving. The Mississippi station reports that shredded corn stover has about 75 per cent the feeding value of Johnson grass, and proved to be a satisfactory roughage for feeding mature mules. Not more than one-third of the hay could be replaced by silage for growing mules.

The Kansas station finds that alfalfa cut in the bud stage makes the best feed for horses. A cheap maintenance ration at the Missouri station for winter for light horses at work was 5 pounds of alfalfa hay with what corn silage they would consume. The average cost of keeping work horses on the farm was \$90.50 per year, exclusive of depreciation. This begins at the close of the sixth year. Feeding makes 72 per cent of the cost of keeping. For the economical management of horse labor a horse should work 800 to 1,000 hours per year. The total cost per hour of horse labor was 7.65 cents.

At the Mississippi station it was found that the growth of the dam is checked by early breeding, and, if continued, normal growth is not obtained. The retarding factor is lactation, not gestation. The Delaware station reports that the danger point in inbreeding is reached when carried beyond 50 per cent.

BACTERIOLOGY.

Bacteriological examination of fresh decomposing horse manure at the Virginia station showed a great abundance of *Bacillus coli*, but after a month only about 8 per cent remained, their place being taken by spore forming and proteolytic forms.

At the Tennessee station it was found that the nitrogen content of the nodules of legumes increases up to the time of blooming and then decreases. The Kentucky station finds that one organism seems to be adapted to all trifolii in nodule formation, but those on the cowpea can

not be transferred to clover. In a study of the transference of the nodule-forming organisms to different hosts at the Georgia station, this was found not to be possible with most forms. Many legumes have no bacteria adapted to them. The Wisconsin station reports that lupine bacteria are best adapted to acid conditions, while alfalfa bacteria do best in alkaline soils, other groups grading between these.

Studies at the Tennessee station show that sugars, alcohols, and esters may supply the carbon requirements of *Azotobacter*; ethers will not. Ordinary variations of farm practice were found to exert no appreciable effect on the activity of *Azotobacter*.

The Kansas station finds no definite relation between the bacterial content and the odor of slaughtered fowl. It was not found feasible to ship poultry by parcel post during summer in Kansas. It was found at the West Virginia station that a pressure of 100,000 pounds per square inch is sufficient to kill all forms of bacteria except a few spores, if dry, but when moist they are easily killed by high pressure. Milk held under a pressure of 70,000 pounds for a few minutes was perfectly sterilized.

The effect of the addition of stable manure on the increase of soil bacteria was studied at the Georgia station. The gas formers increase rapidly at first and then disappear. There is but little increase in the number of *Actinomyces*. At the Delaware station over two million nitrifying and nitrogen fixing organisms were found in a gram of soil in some cases. Lime and manure were found to have considerable effect on the soil flora while phosphate had little effect.

It is noted by the Kentucky station that when sulphur is added to compost nitrification is very rapid. The Oregon station finds that all forms of nitrogen in nitrogenous compounds in the soil are changed by bacteria, the end product being ammonia. The amount formed is a measure of bacterial activity. The rapidity of the decomposition of different protein substances varies.

It is found by the Iowa station that bacteria are responsible for the production of acid and the disappearance of sugar in the silo. Alcohol is first formed by the plant enzymes, then by yeasts. The protein is first hydrolyzed by enzymes, then by microorganisms.

CHEMISTRY.

In the course of investigations as to the utilization of the food stored in the seed by the germinating plant, at the Kentucky station, it was found that in growing the jack bean up to the point at which it begins to die from lack of food, 46 per cent of the mineral matter in the bean remains in the cotyledons. The Iowa station suggests that the mannite formed by fermentation in the silo, might serve

as a commercial source of this material. The natural nitrate deposits in Montana were found by the station to contain as high as 80 per cent of nitrate of potash but they were not in sufficient quantity to be of commercial importance. They are probably formed by bacterial action on bat guanos.

It was found at the Alabama station that pyridin, quinolin, and guanidin carbonate, although toxic in water solutions, nitrify in soils and are then beneficial. This goes on best in acid soils. Nitrification is inhibited by lime and salicylic aldehyde. The injury from vanillin, coumarin, pyrogallol, and quinolin in the soil disappears after about two years, due to breaking up by microorganisms. The toxic principle of cottonseed meal has been under investigation at the North Carolina station. The cooked meal is much less toxic than the raw. After extracting the kernels with ether, they are no longer toxic. The cold-pressed oil is very toxic. The principle has been isolated in crystalline form. Hens and rats were found to be less susceptible to it than pigs and rabbits. At the Connecticut State station the kernels fed exclusively to rats caused death as quickly as if they were starved, but if fed after extracting with ether or steaming, a normal growth was made. The kernels contain an abundance of water soluble vitamin.

Results obtained at the North Carolina station indicate that the potash derived from biotite and muscovite is more available than that from the feldspar group. At the Kentucky station the insoluble potash silicates were found to be gradually made available by the action of bacteria, and two forms which were quite active in this respect were isolated from the soil. The factors that enter into the process of making the potash available from the mineral constituents of the soil are weathering, the action of acids, and the biological factor.

The subject of poisonous forage plants has been investigated by a number of the stations. At the Wyoming station the poisonous principle of the woody aster was isolated as a crystalline substance, insoluble in water and strongly acid. The poisonous action was lost when it was neutralized, which suggests the use of sodium bicarbonate as an antidote. Alkaloids were extracted from different species of the larkspurs and lupines. The early pods of the latter contained the highest percentage. This alkaloid was not soluble in water and watery extracts of the plant were not toxic. A poisonous glucosid was obtained from the milk vetch. At the Nevada station the death camas was found to be poisonous at all stages of growth, but the flowers were the most so. A crystalline alkaloid was extracted from lupine seed. No alkaloid was found in the goldenrod, and it is believed that its poisonous action is due to the high potash content, the

same being true of the rabbit-brush. The saponin in alfalfa was found to be a true nontoxic glucosid. At the Louisiana station forage poisoning by *Paspalum dilatatum* was found to be due to a fungus, *Claviceps paspali*. A poisonous oil was extracted from this by alcohol.

The Nevada station finds the first crop of alfalfa to be higher in ash and protein than the second crop, but lower than the third and fourth. The avocado was found to contain 20 per cent of fat, about equal in digestibility to butter, by the California station. The Kansas station reports the protein kafirin in kafir corn as similar to zein and inadequate for the growth of animals. The Connecticut State station finds that the soy bean contains suitable protein and water soluble vitamins to promote normal growth and enough fat soluble vitamin for long-continued maintenance. Thus it is unlike the majority of seeds, except perhaps peanuts. The ash constituents, however, were inadequate for promoting growth. By using $\frac{1}{2}$ to 2 per cent of yeast as a source of water soluble vitamin, with suitable proteins, carbohydrates, fats, and mineral salts, rats made a normal growth. Calcium, iron, and phosphorus were found to be essential elements, magnesium, sodium, and chlorin being less so. The animals could go a long time without potash. There was some replacing power of sodium and potash. A deficiency of fat soluble vitamin appeared to cause urinary phosphatic calculi.

The Louisiana station considers that the dark color of cane juice is probably partly due to polyphenols which are present in the nodes of the cane, partly to the borers occurring in the internodes, and partly to the use of iron equipment in the sugar house. Sugar deterioration was found to be due to three groups of organisms—bacteria, torula, and molds. The rate of deterioration was diminished at low temperatures, suggesting cold storage for warehousing sugars. The fermentation of table cane sirup was found to increase the purity by fermenting the invert sugar, but spoiled the cans by puffing. It was found that torula could be destroyed by heating to 90° C. for 15 minutes, which, however, might affect the constituents of the sirup.

The Hawaii station has made satisfactory flour from various native sources, including taro, banana, edible canna, sweet potatoes, and cassava.

DAIRY HUSBANDRY.

The Illinois station finds that the construction and condition of the barn has little influence on the germ content of milk, 80 per cent of the bacteria coming from the utensils used. The germ content is not so much a measure of healthfulness as of keeping quality. The New York State station reports that infected udders occasionally supply a large number of bacteria to milk.

That clarification of milk causes an increase in bacterial count was found both by the New York, Cornell, and the Iowa stations. This is probably due to a breaking up of the colonies. The creaming ability is also decreased. Bacteria increase more rapidly in unclarified than in clarified milk. Both the Wisconsin and the Indiana stations find that the best method of pasteurizing milk is to heat it to 145° F. for 20 minutes, this being better than the instantaneous flash method at 165°. The Indiana station finds the first method has a germ-killing efficiency of 99 per cent, and the quality of the butter is improved by this process. Better results were obtained in summer than in winter. Butter fat underwent but slight change in storage, but a cleavage of the protein compounds takes place.

The Iowa station finds that certain yeasts cause foaming of milk, which causes deterioration. Fishy flavored milk was found to be caused by a new organism which was named *Bacillus ichthyosmiius*. Leakiness in butter was found, at the Wisconsin station, to be due to methods of working, temperature of the wash water, churning temperature, and the quality of the fat. The Missouri station reports that the oily flavor and softness of butter, caused by feeding cottonseed meal, can be controlled to a considerable extent by feeding corn silage, the corrective effect being apparently due to the presence of lactic acid.

At the Michigan station it was found that cultures of butter bacteria grow very slowly when 5 per cent of salt is added. A direct microscopical count of bacteria in milk was found to be better than the plate method by the New York State station. The actual number of bacteria was found to be generally more than twice the plate count.

Both the California and Oregon stations have been studying the use of pepsin instead of rennet in cheese making. One-fourth ounce pepsin to 1,000 pounds of milk gave as good a coagulation as 4 ounces of rennet at one-fourth the cost. The curd, however, was not as smooth or tenacious. The Wisconsin station finds that silage is not the cause of the bloating of cheese, as is commonly supposed, it being evidently due to tank infection.

At the Georgia station the effect on the milk of feeding cottonseed meal was to decrease the fat with a slight increase in yield. No change was noted in the composition of the butter fat. The Missouri station reports that the condition of the cow at parturition has an influence on the composition of the milk and butter fat. Doubling the amount of protein in the feed of a cow in poor condition increased the flow of milk, raised the fat from 3 to 5 per cent, and the protein from 3 to 3½ per cent.

ENGINEERING.

The Wyoming station finds that cement sets as well in alkaline as in pure water. Disintegration is due to the removal of soluble compounds that are formed. Trials in treating fence posts with creosote at the New York Cornell station showed that hemlock absorbed 0.774 pound per cubic foot, costing 2.74 cents, and hardwoods absorbed 5.235 pounds, costing 10.3 cents. At the Pennsylvania station creosoted shingles of soft and hardwood showed equal durability after nine years. The cost of creosoting was 50 cents per bundle.

Irrigation studies at the Nevada station showed that the best time to irrigate alfalfa is when the plants begin to show a slight tendency to wilt. With potatoes, moderate irrigation should be given as soon as the plants show this tendency. The critical time with wheat is between the boot and milk stage, but it should be irrigated sparingly during the formation of the root system. Meadow crops require more water than grain, cultivated crops requiring less. Manure and fertilizers reduce the amount of water necessary to produce a crop. Irrigation was found to increase bacterial activity in the soil. The greatest danger lies in overirrigation.

ENTOMOLOGY.

At the New Mexico station the codling moth was found to have four full broods and one partial brood a year. Spraying with arsenate of lead controlled it, three sprayings being necessary on pear trees and five on apple trees. At the Massachusetts station the second brood was not sufficient to require spraying. Fumigation with carbon disulphid was not found very effective in controlling the cowpea weevil at the Texas station, but a temperature of 145 ° F. for 10 minutes killed all stages. The New Jersey station finds that the life of the bean weevil is dependent on atmospheric humidity, the most favorable condition being about 75 per cent moisture. At 26 per cent or below all reproduction ceases. Thus the use of lime in storing will prevent injury. Seed corn may be protected from the grain moth by the same means. The North Carolina station also recommends the use of lime for the control of the common and four-spotted cowpea weevils and the bean weevil in storage.

The New York Cornell station reports that the poplar and willow borers can be controlled by treating the trees up to four or five feet above the roots with some of the coal-tar products. Wireworms were found to be easily controlled at the South Carolina station by regulating the moisture content of the soil. They were found to be scarce when it reached 12 per cent. The New Jersey station finds that sodium cyanid applied to the soil at the rate of 100 pounds per

acre will destroy wireworms in the laboratory, but this was not efficient in the field.

An outbreak of the cottony cushion scale was completely checked by the introduction of the Australian ladybug at the South Carolina station. At the Indiana station it was noted that the corn-root borer appeared only in fields in which timothy was previously grown. For the control of the European corn borer the Massachusetts station recommends burning, burying, or feeding the stalks to stock, or silaging. The corn billbug was effectively controlled by early planting at the North Carolina station. It was found at the Florida station that the velvet-bean caterpillar will attack peanuts in fields adjacent to the beans. Dusting with lead arsenate and lime controlled them. Cyanid at the rate of $\frac{1}{2}$ to 3 tons per acre gave promising results for the control of nematodes.

The Washington station is now using the hemolytic action on rabbits to detect differences in strains of scales. It was found that the San José scale from different localities showed a difference in resistance to sprays.

A temperature of 85° F. with 75 per cent humidity were found to be the optimum conditions for the Hessian fly at the Kansas station. Wind is an important element in its dissemination. It has been found 2 miles away from an infected field, and in one case 5 miles. Early working of the ground is recommended. The Missouri station also recommends plowing under stubble immediately after harvest, cultivation to keep down volunteer wheat, and seeding after the fly date.

It was found at the Kansas station that where aphids were completely controlled apple and pear blight was eliminated. The New York State station reports effective control of apple aphids with lime-sulphur and nicotin sulphate. In a study of the control of apple aphids at the New Jersey station, 95 per cent were destroyed by coating them with winter strength lime-sulphur and 98 per cent were killed when wetted with a 2 per cent solution of crude carbolic acid to which enough soap was added to break the surface tension. A thorough spraying of the trees with a mixture of lime-sulphur and 40 per cent nicotin, 1:5,000, is recommended just as the leaves begin to develop. This will also control the pear psylla, applied just before the blossoms open. The Maryland station finds that spraying the roots and crowns of nursery stock with an 8 per cent emulsion of pine-tar creosote controlled the woolly aphis.

At the West Virginia station oil sprays gave the best results against apple-tree borers, with an efficiency of 80 to 90 per cent on a commercial scale. The round-headed apple-tree borer was controlled by screening the trees. Painting with asphaltum keeps the beetles from

laying eggs in the bark. The Arkansas station found cases where this borer deposited eggs and developed in the fruit. It was found that arsenate of lead would poison it, but it was best controlled by pruning the trees in August or early September. Asphaltum gave a protective efficiency of 82 per cent. None of the measures taken against the peach-tree borers was successful, but at the Oregon station fairly good results were obtained with asphaltum and wrapping.

At the Maryland station the fly-maggot trap has been very successful, the reduction in the number of flies being very noticeable. A 3 per cent solution of pine-tar creosote in caustic soda was a good protection for cows against flies and resulted in an increased milk production. The New Jersey station finds that ammonia is the chief constituent of manure that attracts the house fly. The use of poisonous bait resulted in considerable mitigation of the nuisance. For the control of greenhouse pests, millipedes were controlled by the Maryland station with tobacco preparations, and the Massachusetts station reports the successful control of the red spider with soap and linseed oil. Dust and sprays were effective in controlling the striped cucumber beetle at the Missouri station. Young nymphs of the squash stink bug were killed by nicotin, but the adults were only stupefied.

The Alabama station finds that corn weevils gather in the earliest maturing areas, these serving as traps. The corn in these should be gathered within six weeks after the roasting-ear stage and fed at once without husking. It is best to husk the corn in the field and store bare, as the husks tend to retain rather than exclude weevils. Sprinkling with naphthalin helps to keep out weevils. Stalks and refuse should be silaged.

For the control of the strawberry weevil, the New Jersey station recommends dusting with a mixture of sulphur and lead arsenate, using a wire-screen sifter covered with wire cloth for small areas. Root borers were controlled by tobacco dust mixed with lime at the New Hampshire station.

FARM MANAGEMENT.

The Iowa station finds that labor income increases up to about 400 acres and then decreases. Heavily stocked pastures gave larger labor income returns than light. The highest priced lands were the cheapest from the standpoint of profit. At the Kansas station it was found that the farms of the State were lacking in organized diversity. There was a tendency to invest too much money in land and not enough in equipment. Stock share-leased farms gave the largest returns, comparing favorably with owned farms. Cash tenancy farms gave the least returns. At the Mississippi station it was found that the proportion of locally grown food products handled by local stores was small.

HEREDITY.

The Illinois station reports that unit characters are inherited independently in mammals, following the law of chance. The high protein content of corn is considered to be recessive at the Minnesota station and should be readily segregated. At the New York Cornell station 30 distinct Mendelian factors have been isolated in corn and independent inheritance proved in some cases. The Connecticut State station finds that hybrid improvement in corn breeding can not be secured as a sex-fixed strain. In experiments in xenia in corn, protein has been increased 15 to 16 per cent.

In crossing awnless and awned oats at the New York Cornell station the second generation gave awned, partially awned, and awnless in the approximate proportion of 1:2:1. The results of several years' observations on wheat failed to show any cumulative effects of environment. Studies made on inheritance in pure-line breeding of wheat at the Ohio station show that there is no variation of heritable characters that can be varied by present methods of breeding.

The Iowa station finds that the black and red pigment of cattle is an independent allelomorphic pair of characters. The short-ear trait in sheep was found by the New Hampshire station to be a simple Mendelian unit factor. The Missouri station reports that spangling in the plumage of fowls is determined in inheritance by a distinct factor which behaves in a sex-linked fashion, the cocks being homozygous, the hens heterozygous. When spangling is introduced through the male both sexes show spangling; but if introduced through the female, only the males are spangled. The spangling factor is an independent one.

At the North Carolina station 30 type plants were isolated by self-fertilization from a single variety of cotton, showing the lack of uniformity in common varieties. The Arkansas station finds that the characters of the pistillate plants in apples are dominant in the progeny.

HORTICULTURE.

At the Virginia station cultural treatment was found to have more effect on the orchard than differences in fertilization. Clean culture with cover crops in midsummer was found to be the best orchard management for Nebraska. At the Indiana station orchard trees on bare ground made a poorer growth than with cover cropping. Cover crops were found to maintain a uniform and high soil temperature. Weeds were not of much value as a cover crop owing to the ununiformity of stand. At the Washington station cover crops that furnish the most vegetable matter were the best, irrespective of the crop itself. With no fertilizer, mulching gave better results

than tillage or cover at the Pennsylvania station on young orchards. With fertilizers, the cultural methods are of less importance. Tilled intercrops with fertilizers gave good results, potatoes being good for this. At the Arkansas station the effect of fertilizers on young apple orchards was negative, but continued applications show effects on older orchards. Nitrate of soda at the time the buds were starting into growth was of value at the Pennsylvania station. Lime or phosphoric acid alone had no appreciable influence. No fertilizer had any effect in improving the color of the fruit, nitrogen having a tendency to reduce it. At the New Hampshire station nitrification studies in the orchard showed that this proceeded slowly in the sod plats, and that soil moisture was not the limiting factor. On the cultivated plats stirring the soil increased nitrification, as did the addition of lime. Under a good system of tillage nitrates were usually present in excess of the needs of the tree. Soil temperatures in the orchard were highest under clear surface and lowest under the heaviest vegetation in the summer, the reverse being true in winter. Air temperatures were more closely related to growth than any other factor. At the Missouri station nitrogen was the limiting factor for fruit production in apple orchards on light soils, but on rich soils it delayed fruiting. On medium fertile soils the application of chemical fertilizers was made at a loss. More blight occurred on apple trees abundantly supplied with nitrogen; with peach trees nitrogen caused later maturity, the formation of more fruit spurs, later spring activity, and the trees were more susceptible to brown rot.

At the Virginia station root pruning, ringing, girdling, and stripping was found to stimulate the trees, but the wounds must be protected. Severity of pruning had no effect on average tree growth. At the Indiana station lightly pruned trees produced more and better fruit than those heavily pruned. Summer pruning at the Idaho station gave greater yields, intensified the color, and hastened the bearing of young trees, but checked total wood growth slightly. At the Kansas station summer pruning produced more evenly developed and better-balanced tops. It is believed at the New Hampshire station that the annual bearing of fruit trees can be secured by pruning. The yearly departure from the mean growth must be small in order to secure regular fruiting. At the New Jersey station summer pruning delayed maturity of the fruit and encouraged wood growth.

Under conditions prevailing in the Southwest, it was found at the New Mexico station that late-planted Irish potatoes gave the best results, allowing the plants to grow in the hot weather and the tubers to form in the cooler season. Sugar beets were successfully grown in the State with an average sugar content of 13 per cent. Seeding the last of April gave the best results. Analysis of the soil around chlorotic trees showed a deficiency of humus, lime, magnesia, and

iron. An application of iron sulphate temporarily corrected it, but it returned. Attempts to introduce varieties of beans, strawberries, blackberries, and raspberries in the State were not successful on account of the heat and dry weather. Japanese plums did well. At the Texas station hybrids were secured between the dewberry and raspberry, with very fine fruit, the raspberry characters predominating. The New Mexico station reports that cotton can be successfully grown in some of the irrigated valleys of the State, Burnett yielding 1.47 bales of lint cotton per acre.

For purposes of propagation there was no difference between large and small buds or buds differently situated on the tree or shoot, as found by the Illinois station. Seedlings from the seeds of large fruit had greater vigor than those from small fruit. Large fruit have a higher average seed production. The Pennsylvania station finds that in the selection of tomato seed fruit should be chosen from plants having a large percentage of desirable fruit rather than from superior fruit from poor plants. It was found at the Nevada station that a temperature of -10 to -15° F. for two hours will injure and often kill young apples trees. At this temperature the stock roots were killed but the scion roots only injured.

At the Florida station citrus trees grown in tanks were injured more by low temperatures than those in the ground. Plats receiving an excess of fertilizer were more severely injured than those receiving a normal amount. Heavily fertilized and limed trees showed frenching. At the Nebraska station transpiration from a given leaf area of corn was about one-third the evaporation from a free surface of water of the same area. The water requirements per pound of dry matter is larger in infertile than in fertile soils. Malnutrition causes a relatively high water requirement. At the Washington station the winter desiccation of fruit trees was found to be due to nutritional disturbances. Top-working apple trees at the Iowa station produced larger crops and better-sized fruit. Nectar was found to be most abundant early in the blooming season and most pronounced at the time of opening of the flower. The South Dakota station has had much success in crossing hardy Asiatic plums and pears on native stock. The Washington station finds that orchard pollination by insects is only effective in cross-pollination. Pollen in some cases retained its vitality for 26 days. A definite relation was found to exist between leaf area and leaf-bud formation at the Oregon station. The New York State station emphasizes the fact that the European grape should be grafted on phylloxera-resistant roots.

At the South Carolina station the yield from male asparagus plants was twice as heavy as from female. At the Pennsylvania station planting large asparagus crowns yielded a crop worth \$100 more per

acre than small ones. Vegetable seeds were found to lose their vitality rapidly at the Guam station, showing much deterioration after three or four months. The Porto Rico station finds that mango seeds can not be used for propagating varieties, as the progeny do not come true. At the Pennsylvania station a case of lack of whiteness of ash and poor-burning quality of tobacco was found to be due to the exclusive use of barnyard manure and was corrected by the application of potash and phosphoric acid.

INSECTICIDES.

The Minnesota station finds that the toxicity of organic compounds is dependent on the degree of volatility, low-boiling compounds being more toxic than high. Chloropicrin is suggested for grain fumigation and furfural for ridding living plants of insect pests. The neutral arsenates were found to produce more burning than the acid preparations at the Alabama station. The Massachusetts station reports considerable burning of the foliage from Paris green. It was found that arsenite of lead was difficult to control and the use of arsenate is recommended instead. Fruit with best keeping qualities resulted from the use of a combination of lead arsenate and lime-sulphur at the Missouri station.

Results at the Oregon station show that tricalcium arsenate is a good insecticide, but it should not be used alone. It is best mixed with lime-sulphur or an excess of calcium oxid. Nicotin sulphate alone had a killing efficiency of 84 per cent on codling moth eggs, which was increased to 99 per cent when used with soap.

At the Maryland station fumigation of greenhouses with hydrocyanic acid was most effective in the dark and at a low temperature, with a dry atmosphere. The New Hampshire station reports that the cuprammoniums are more toxic when slowly than when quickly dried, and show more toxicity and weather resistance than Bordeaux mixture, when large amounts of soluble copper are required to give protection. They should not be used in place of Bordeaux when this yields sufficient soluble copper for protection. Sulphur proved to be an efficient fungicide for the control of certain rusts under greenhouse conditions, but its value for field applications was considered doubtful.

PLANT INDUSTRY.

Many stations have experimented with the potato. The Montana station finds that thinning to one stem to the hill reduced the yield of marketable tubers, but also reduced the percentage of culls and improved the quality. The Oregon station reports that seed from the eye end give more vigorous plants and a larger yield than from the

stem end. At the Pennsylvania station planting potato peelings yielded 31.5 bushels per acre, eyes cut with a conical piece, 78.3 bushels, and cut in the usual way, 152 bushels. Seed slightly immature gave better yields than mature seed. Sun sprouting before planting did not increase the yield. The Connecticut Storrs station finds that it is not advisable to use home-grown potato seed continuously.

Both the Alabama and the South Carolina stations have developed a wilt-resistant strain of cotton. The latter station finds that it requires from a fourth to a third more water to produce cotton on poor than on fertile soils. About one-third of the total requirement is used in the month of August and as much is required in September as in July. The Georgia station finds that the water requirement of cotton increases with the increase of soil saturation. Egyptian cotton has been successfully grown at Fresno by the California station, and the Guam station has demonstrated the possibility of raising cotton on the island. In the cotton-breeding experiments at the Mississippi station, Lone Star yielded a money-value crop of \$108.37 per acre, which was \$50.83 more than the parent strain.

Experiments at the Alabama station show that plants can obtain a part of their carbon from the soil if it is in a soluble or available form. At the Vermont station it was found that sugar in the maple is a protective agent, the tree resisting temperatures that freeze the birch, and break dormancy three weeks earlier in the spring. A definite relation was found to exist at the Massachusetts station between elevation and the killing temperature for buds. The Missouri station finds that the bearing parts of fruit trees have a higher percentage of moisture and the sap is more concentrated than in the unbearing portions. Blossoming spurs had fewer and smaller leaves than others. Alternate bearing could be controlled by thinning and pruning.

The North Dakota station reports that corn for seed should not be harvested before the glazing stage. By preventing the pollination of corn at the Kansas station, grain was produced with a higher percentage of protein and a lower percentage of crude fiber. It was found that corn leaves do not increase in dry weight after 10 a. m. in dry weather, while milo leaves continue to manufacture food throughout the day. In crossing ordinary varieties of corn at the Connecticut State station, 88 per cent of the crosses yielded more than the average of the parents and 60 per cent yielded more than either parent. The Missouri station finds no correlation between characters and yield in corn. The second third of the growing period was the most important from the standpoint of water and nutrition. The moisture requirement was found to be constant, regardless of nutrition.

Nearly all of the progeny of selfed strawberry plants at the Vermont station were perfect and all imperfect strains were hybrids in sexual construction. At the West Virginia station breeding failed to fix the type in strawberry selections. Heavy applications of lime had no effect. The largest yield resulted from the application of nitrogen. On the other hand, at the Missouri station, nitrogen appeared to be detrimental, phosphoric acid giving the largest yield. Potash gave no results. The Oklahoma station reports that the falling of tomato blossoms is due more to dry air and soil than to the thrips. Straw mulch increased the yield, gave stronger blossoms, and earlier and larger fruit.

Artificial pollination of greenhouse tomatoes was very profitable at the Oregon station. Without artificial pollination, 33 to 45 per cent of a crop was obtained; with such pollination, 60 to 80 per cent of the blossoms produced fruit. This should be begun within the first 10 to 14 days of blossoming and be repeated every three days. In one case an increase of 125 pounds of fruit was obtained from 100 plants at an extra cost of 50 cents, the extra fruit selling for \$18.75. The Kansas station obtained the largest yield of tomatoes when the plants were not pruned, but there were more sunburned fruit. Pruning to two or three stems was best.

At the Washington station it was found that the nitrogen content of wheat could be increased both by cultivation and keeping up the humus and nitrogen content of the soil. Wheat grown under dry-farming conditions at the Colorado station was not superior to irrigated wheat. The determining factors are distribution of rainfall and cloudiness, resistance to rust, temperature, and soil fertility. The nitric nitrogen of the soil was found to bear a direct relation to the nitrogen content of the grain and plant. Rust was found to inhibit the transfer of material to the seed just before maturity, and thus caused a depression of the protein content of the grain. At the Kansas station a variety of wheat, the "Kanred," was developed, with high milling properties and quite rust resistant, which gave a yield of over 31 bushels per acre. The Missouri station finds that wide spacing of wheat renders it more liable to winter killing.

Soy bean and pea flours were found to be good mixtures in wheat flour at the Washington station, the bread being light and pleasing to the taste and compared theoretically better than pure wheat bread in nutritive value. Twice as large yields of beans were obtained at the Rhode Island station, where stable manure had been applied continuously than where chemical fertilizers were used. At the Oregon station it was found that good silage could be made from vetch if water was added to it. The common variety was best for forage. Analysis of growing sorghum at the Kansas station showed

that the percentage of crude fiber and protein decreases and the nitrogen-free extract increases as the plant matures. At the Rhode Island station grass deprived of potash until the crop was reduced one-half increased by one-third on adding salt. This may prove useful when the soil is deficient in available potash. In green-manuring experiments at the Mississippi station increasing amounts of cowpeas were turned under up to 50 tons green weight per acre. Oats grown in these pots kept increasing in yield up to that point, showing that the limit had not been reached. The number of bacteria increased with the amount of green manure. At the Kansas station the percentage of protein in Sudan grass was closely related to the yield. The largest amount of total nutrients was obtained when the plants were in full bloom.

Through the introduction of fruit-drying plants by the Washington station, 225 tons of fruit a day was saved during the season. The West Virginia station finds that nearly all varieties of apples are self-sterile. Severe summer pruning was detrimental to fruiting; the lighter the pruning the greater the yield. Thinning overladen apple trees always resulted in improvement of the crop in size, color, and quality. The Georgia station reports indications that the hickory can fertilize the pecan.

The Massachusetts station finds that there is no necessity of fertilizing good cranberry bogs. Nitrogenous fertilizers produced a rank growth of vines, and in the form of sodium nitrate it injured the keeping qualities of the berries. The character of the weeds in the bog was some indication of the treatment necessary. The dominant requirement of sweet clover was found to be lime. The continued use of sodium nitrate reduced the necessity of applying potash.

At the Louisiana station doubling the amount of phosphate from 250 to 500 pounds per acre increased the crop of cane 5 tons. Garlic proved to be a good winter crop for rice lands, yielding 2,000 pounds per acre. The use of potash on rice was only profitable the first year. At the Maryland station the Clinton grape was found to have a dominating influence in transmitting its vigor and hardiness to its offspring, even on tender types. Acidity of fruit, measured by the concentration of the hydrogen ion, at the Delaware station, showed small variation in different fruits and was quite constant throughout the growth of the fruit, indicating that the optimum acidity for metabolic changes is confined to a narrow range. This is different from the total acidity by titration. This station also reports that the apple responds slowly to differences in plant food until the starvation point has been reached in one or more of its food requirements. The peach responds much more readily. The

application of sodium nitrate gave a constant increase in fruit production.

At the Alaska station alfalfa varieties were winterkilled at Fairbanks, except *Medicago falcata*. Excellent hay crops were secured from red clover seeded May 12. At the Rampart station *Trifolium lupinaster* was found to be hardy and to produce a good crop of seed.

PLANT PATHOLOGY.

The Ohio station finds that fire blight of apple and pear is transmitted by bees and other insects. The black rot of the apple, as reported by the Virginia station, is caused by a species of xylaria, not previously considered pathogenic. It is more prevalent in newly cleared and on stump land. Indications point to infection through the soil, and it is spread by cultivation. The best method of control seems to be to find some resistant root stock. The North Carolina station also reports the xylaria as causing apple root rot. The Virginia station reports that apple scab can be controlled commercially with sulphur, arsenate of lead, and lime. At the Illinois station spraying for apple blotch with Bordeaux mixture 3, 4, and 7 weeks after the fall of the bloom was successful.

For the control of blister canker of apples the Iowa station recommends cutting out all diseased parts and painting with white lead or corrosive sublimate. The Missouri station recommends the same treatment. The New York State station finds it is best controlled by orchard management to keep up a vigorous growth. The Montana station notes that apple trees that have suffered from winter injury are subject to canker. At the Idaho station apple rosette is believed to be due to physiological causes connected with certain climatic conditions. The West Virginia station reports that in controlling apple rust clearing away cedar trees in a radius of 2 miles from the orchard proved of great advantage.

The Virginia station finds that the leaf-spot disease of tobacco occurs only on mature or nearly mature plants. It does not affect tobacco grown on unfertilized land, or when no phosphoric acid has been applied. Mosaic disease of tobacco is found by the Massachusetts station to be highly infectious but not contagious. It is not carried by bacteria or fungi. It is believed to be induced by disturbance of enzymic activities due to abnormal metabolism. The so-called "tobacco sickness" is caused by the root-rot fungus. It is less prevalent in acid soils. Ninety per cent of the tobacco fields were infected.

Three species of *Fusarium* were found in watermelon wilt by the Texas station that were not capable of producing the disease on other hosts. The Missouri station finds that wounding is not prerequisite for the entrance of *Fusarium* into the stems and roots.

The Connecticut State station reports that rotation with corn and potatoes is the best preventative of the rot of the latter. The organism causing it was found by the Wisconsin station to attack plants when the soil temperature ranged from 15° to 24° C. but not at 27° or over. It was found to be spread by soil infection. At the Nebraska station removal of diseased stem ends greatly reduced *Fusarium* stem-end rot of the potato. Potato blight at the Iowa station was controlled by Bordeaux mixture, best in five applications during the last half of the summer. Both the Iowa and the Vermont stations report the successful control of tip burn with Bordeaux mixture. The latter station reports that chlorophyll destruction bears a relation to the disease, and that potatoes grown under shelter are free from it. At the Montana station seed potatoes infected with *Fusarium* dry rot gave good yields, the transmission of the disease by seed being unimportant. At the Vermont station it was found that thick-skinned, russeted potatoes are generally free from scab, thin-skinned ones being very susceptible. There was no constant relation between the bacterial content of the soil and the disease. The Utah station finds that sclerotia of potatoes is not killed by ordinary treatment unless the tubers are previously soaked. Many diseases were found to be transmitted through the seed, even if there is no external evidence, by the Oregon station. The New York State station finds leaf curl, curly dwarf, and mosaic disease of the potato to be closely related, and the New Jersey station finds that tubers infected with these diseases give yields below normal, and to a less extent this is true of *Rhizoctonia* infection. Normal sprouting of the potato was found to require about 19 volumes of air per volume of tuber, and if less is present blackheart is liable to appear.

The Minnesota station has made important contributions to the pathology, morphology, and physiology of the rusts. At the Iowa station the European barberry was found to be the most important agent in spreading the black-stem rust of small grains. A species of wild *Hordeum* was found by the Idaho station, on which the wheat stripe rust appears to winter.

Soaking seed in formaldehyde solution to control the loose smut of cereals is recommended by the Minnesota station. The Washington station finds that smut spores will travel great distances from the thrashing machine and thus infect soils in the whole wheat belt. Deep plowing of summer fallow and spreading and burning straw on fallow fields is recommended for its control.

The New York Cornell station reports that 90 parts sulphur with 10 parts lead arsenate will control most leaf diseases in the nursery. The crown canker of roses was best controlled by soil sterilization and by selecting healthy stock. At the North Dakota station treatment of the seed of cereals and flax with a soap emulsion of crude

creosote gave good results against seed-carried diseases. The Washington station finds about a dozen species of weeds and all crop plants except cereals act as host plants to *Rhizoctonia*. The organism is capable of living several days in the soil. The Michigan station also finds that the spores of anthracnose and blight live over in the soil. An attempt by this station to find a biological method for determining and identifying molds and fungi by injecting small doses of the extract into guinea pigs and noting anaphylactic shock on larger doses gave good results.

Plum-pocket disease was controlled at the Montana station by one application of lime-sulphur. At the Alabama station citrus canker was found to penetrate the foliage very rapidly. The organism was found to be alive after 17 months in a dry soil, the number and growth increasing rapidly when water was added at the Florida station.

Cotton anthracnose was found to be killed by desiccation by the South Carolina station. Good results followed treatment of the seed with sulphuric acid if the infection was external and with hot water if internal. Studies on the angular leaf spot of cotton at this station showed that it is disseminated by splashing during rainstorms accompanied by wind. The causal organism appears to winter inside the seed. Cotton-boll shedding was found by the Arkansas station to be a phase of this disease. The streak blight of tomato was produced by inoculation with the extracted juice of diseased plants by the Indiana station, but the causal organism was not isolated. A new leaf spot of cucumber, caused by a species of *Stemphylium*, was controlled by Bordeaux mixture.

At the North Carolina station it was found that the wilt disease of lettuce and clover was not caused by the same organism, but that the same organism that causes cowpea wilt also causes blight disease or *Fusarium* wilt of the soy bean. A study of "damping off" at the Florida station showed that *Rhizoctonia solani* was the most common organism present, but may not be the sole cause of this trouble. A one-half per cent solution of copper sulphate applied at the rate of 1 pint per square foot was helpful in its control. The same station finds that the buckeye rot of tomato is caused by a new species of *Phytophthora*. It occurs only in humid conditions and when the fruit is in contact with the soil, or nearly so. The same organism was isolated from many cases of foot rot of citrus. No relation was found between gummosis and type of soil, moisture conditions of the soil, or variety of citrus. It was most prevalent in grapefruit and sweet oranges. Cutting out the affected parts and treating with carbolineum was found to control it. Both melanose and dieback of citrus were controlled to a considerable extent by pruning out all dead wood. Cherry-tree gummosis was found by the Oregon station to

attack the foliage, the organism being carried there by rain. Chlorosis of sugar cane is considered by the Porto Rico station to be due to lack of assimilation of iron, caused by carbonate of lime in the soil. At the Hawaii station pineapple yellows was found to be due to a high content of manganese in the soil and was prevented by spraying the plants with a solution of sulphate of iron three or four times during the season. As a result, 5,000 acres of abandoned pineapple land was restored to cultivation of the crop.

It was found at the Michigan station that mosaic disease of the bean was carried in the seed. Stem-end blight of field and garden peas was found to be caused by *Pseudomonas pisi* by the Colorado station. It enters the stomata or mechanical injuries. The California station reports that the curly leaf of sugar beet is spread by a species of *Eutettix*. It is believed that the June drop of navel oranges is due to extreme variation in transpiration between day and night coupled with attacks of a fungus. Valencias are not subject to it.

For the control of neck-rot disease of onions the New York State station finds that soaking the seed in formaldehyde solution for 20 to 30 minutes and spraying the crop with Bordeaux mixture was efficient. The West Virginia station finds that many tomato diseases can be controlled either by Bordeaux or sulphur dust, or by spraying with Bordeaux, the latter also being good for the control of apple diseases. The New Jersey station reports that a modified Bordeaux spray will control most of the foliage diseases of the tomato. The Connecticut State station advises clearing areas infected with pine-leaf blister rust of currants, gooseberries, and other species of *Ribes*. It was found that infection could be carried from the pine to *Ribes* and among *Ribes* themselves.

At the Louisiana station eggplant blight was found to be carried over in the seed and in the refuse from the crop in the field. Peruvian alfalfa was found to be more resistant to crown rot than other varieties. "Straight head" of rice was controlled by delaying irrigation or allowing land to become dry during the growing season. The Maryland station reports that tomato blight occurs in other plants, as the potato and horse nettle, but does not do serious injury to these. The Wisconsin station reports that no development of the fungus causing cabbage wilt takes place as long as the soil temperature is below 60° F. Onion smut was controlled by soaking the seed in formaldehyde. At the Delaware station it was found that anthracnose of watermelons, cantaloups, and cucumbers was caused by the same organism.

The plum-wilt organism was identified by the Georgia station as a new species of *Lasiodiplodia*. Sterilizing borer holes controlled it. Attempts to control walnut blight with sulphur and tobacco dust at the California station were not successful, but aphids were completely eliminated by this treatment.

PLANT PHYSIOLOGY.

The New York Cornell station finds that the beginning of cambial activity varies in different plants. In grapes it begins from May 23 to 29 and ceases before August 9. In the peach it begins with the opening of the bud and is in a resting condition by July 19.

The Florida station reports that the frenching of citrus trees bears a direct relation to the amount of lime in the soil, those plants receiving lime being the most chlorosed. Die-back was found to be due to excessive amounts of organic matter in the soil. It occurs only in cases of rapid growth. The application of 2 pounds of bluestone to the tree controls it. Trees receiving the highest amount of potash escaped injury from the freeze.

The New Jersey station finds a marked difference in the viability of seeds and vigor of seedlings correlated to the amount of abortiveness between that taken from the base, middle, and tip of the pods of leguminous plants.

POULTRY.

The New Mexico station finds that cottonseed meal can replace meat meal to advantage to a considerable extent, but at the North Carolina station excessive feeding of the meal was injurious, and the Oklahoma station finds beef scrap superior to cottonseed or peanut meal. The Arkansas station also reports meat scraps as being superior to cottonseed meal for laying hens, the cost per dozen eggs being 3.6 cents less with the former.

At the Kentucky station a decalcifying process was found to take place on a restricted diet, resulting in polyneuritis and osteomalacia. A proper calcium balance should be maintained. Comparing free range with confinement at the Kentucky station, the former was found to be more profitable for egg production. The Ohio station reports range feeding to be worth from \$10 to \$30 an acre in the lower cost of feed and increased egg production.

The Texas station reports that skim milk was the best and most profitable source of protein for poultry, peanut meal being the poorest. The Montana station also reports that skim milk gave the highest annual egg production. Skim milk proved better than beef scraps for feeding chicks at the Missouri station, and the Wisconsin station reports that the addition of milk to the grain ration gave three times the growth produced by grain alone. Animal food increased egg production and reduced the food cost per dozen eggs. At the Idaho station a comparison of animal and vegetable protein for egg production gave the best results with the narrowest animal protein ration. The West Virginia station finds that large amounts of animal protein tend to weaken the vitellin membrane. The California station reports good results from the substitution of coconut

meal for barley to the extent of 25 per cent. At the Missouri station it was found that protein concentrates of vegetable origin had no influence on egg production.

The New York Cornell station finds that a close relationship exists between external measurements and appearance of the fowl to egg production. The Oregon station, however, finds results rather against the theory of the correlation of conformation to egg-producing quality. The size, shape, and color of eggs were found to be heritable characters by the New York Cornell station, and the Massachusetts station finds that the winter cycle of egg laying is also inherited. At the Connecticut Storrs station the color of the ear lobes, shanks, vent, and beak was found to be an indication of laying capacity, a yellow color indicating a poor layer.

A study of nesting habits at the Iowa station shows that better results were obtained if the nests were secluded. Those containing four eggs were better than empty ones, and plaster of Paris or wooden nest eggs were better than glass ones.

The Montana station reports that Leghorns can be profitably kept for three or four years, and the Utah station finds that the first winter's record is not an indication of future performance. At the Oregon station early-laying pullets generally proved the best layers throughout the year.

Crate feeding roasters at the Montana station was profitable, increasing the weight and improving the quality of the meat. At the Connecticut State station chicks were raised to maturity on artificially prepared mixtures of nutrients, with blotting paper to supply bulk. The Massachusetts station finds that broodiness is a sexual and individual quality and that the time between varies with the individual. Unsexing and implanting ovaries in cockerels resulted in full growth and the production of spurs, but the feathers and comb were those of the female.

At the Oregon station eggs in dry incubators gave less pipping than in moist or in nests. The chicks were smaller, and there was a larger amount of unabsorbed yolk. The Maryland station states that eggs for hatching should not be kept over two weeks. Poor hatches of eggs were found to be usually due to the quality of the eggs rather than to faulty incubation at the New Jersey station. The causes that contribute to the hatchability of eggs included breed, age, season, productivity, vigor, vitality, and individuality.

The West Virginia station reports the larger the egg the larger the yolk, but the percentage of yolk to egg is smaller. With eggs laid in cycles the first is the heaviest. The Connecticut Storrs station reports no advantage in alternating cooling eggs as the hen does. Cooling lengthens the time of incubation. Sixteen hours was the limit of time that cooling could be borne without injury at any time during incubation.

Trials of different sources of lime for egg production, at the Wisconsin station, showed a 30 per cent increase with clam or oyster shells over other forms. The West Virginia station finds that eggs sterilized with hydrogen dioxid and wrapped in cotton kept well when stored in a cool place.

SOILS.

It was found, at the Ohio station, that considerable of the phosphorus in certain soils may be in organic combination. In a study of the effect of the nitrogen and phosphorus supply in the soil on the character of wheat, the largest percentage of protein in the crop occurred where the soil was deficient in available phosphorus and was fertilized with sodium nitrate. It was found that plants are better able to utilize phosphorus when conditions are most favorable for plant growth by providing an available supply of nitrogen. The protein content of wheat was less on soils where nitrogen was supplied from organic sources. At the Virginia station 200 pounds of acid phosphate gave as good results as 600 pounds per acre. A number of stations have demonstrated the fact that rock phosphate can be made available by composting with sulphur and manure. At the Indiana station acid phosphate was the most profitable fertilizer alone or in combination. Results with rock phosphate were irregular. The North Carolina station reports that eastern soils are low in phosphorus, but that this is not the limiting factor in most soils at present.

Extensive studies in soil acidity have been made by various stations. At the Ohio station it was found that ammonium sulphate accelerated the decomposition of carbonates, while manure appeared to conserve the bases supplied by lime treatment. At the Virginia station it required six years' application of lime at the rate of 1,800 pounds per acre to make soil alkaline, after which the yield was easily maintained with small applications of phosphate. The acidity resulting from green manuring was found to be very transitory. The New York Cornell station finds that there is a much greater loss of lime from bare than from cropped soils. Burnt lime gave better results than ground limestone. At the Indiana station ground limestone gave profits ranging from \$3.31 to \$18.34 per acre on different types of soils. At the North Dakota station the presence of iron and alumina compounds was found to be one of the factors of soil acidity. The Florida station finds that acidity increases in the summer and decreases in the winter. The Michigan station reports that in acid soils the ratio of calcium to iron and alumina, soluble in fifth normal hydrochloric acid, is about 1 to 3; in alkaline soils below this. This is used as a basis for calculating the amount of lime necessary for an acid soil. The active acidity of soils and their lime require-

ments are not necessarily correlated, according to the West Virginia station. The Rhode Island station finds that a part of the injurious effect of acid soils is due to the presence of alumina salts, and the beneficial action of lime is believed to be partly due to the precipitation of the alumina from the soil solution. Plants grown in solutions containing alumina salts show much the same effect as those growing in acid soils. Alumina is more toxic to barley than to rye, which corresponds to the effect of acid soils. By keeping the soil of a lawn acid by the application of ammonium sulphate, weeds were eliminated, especially crab grass. Thomas slag showed about one-third the efficiency of limestone as a neutralizing agent. The Wisconsin station reports that the influence of soil acidity on plants appears to be an indirect one, preventing them from getting sufficient lime for normal fruiting and growth. The nature of the root system plays an important part in the ability of plants to acquire lime and withstand soil acidity. The Pennsylvania station finds that heavy cropping has a tendency to produce acidity. A high magnesium limestone was not found to be injurious. This is confirmed by results at the Rhode Island station, but the Missouri station finds that this is dependent on the type of soil.

At the Virginia station the yield of corn was higher where clover was all turned under than where it was cut and removed. In the former case the yield was 26 bushels, in the latter 18.4 bushels, per acre. Green manuring was found to have a somewhat inhibitory effect on bacterial activity. Spring applications of manure at the Massachusetts station gave better results than winter applications.

The Virginia station finds that nitrification always requires air, but ammonification and nitrogen fixation may be aerobic or anaerobic. Denitrification goes on a little better under anaerobic conditions. At the Tennessee station it was found that the utilization of nitrogen from different manurial sources varies in different soils and that the manurial content of the crop was appreciably influenced by the kind of soil. The New York Cornell station reports that nitrogen as well as lime and magnesia are conserved by growing crops but that potash is not. Oxidation and reduction of nitrogen compounds were found to go on concurrently. Corn was found to have a stimulating effect on nitrate formation. At the Montana station it was found that wheat on fallow stood the dry season better than on continuous wheat plats. The latter apparently compacts the soil and hinders nitrification. Nitrates accumulate under bare fallow if carbonaceous material is present to supply energy to the bacteria. At the Idaho station it was found that sawdust depressed nitrification and ammonification unless 1 per cent of calcium carbonate was present. Conifers depress more than hardwoods. Maple stimulated it slightly,

apparently owing to the sugar. There appeared to be a direct connection between the soil content of available nitrogen and the protein in the wheat kernel. At the Utah station it was found that sodium chlorid, calcium chlorid, sodium sulphate, and calcium nitrate were toxic to ammonifying organisms. Compounds which were stimulating to higher plants also acted stimulating on bacteria. One species of nitrifying organism has been isolated and grown on pure cultures by the Colorado station. The cause of spotted growth in grainfields is believed, at the California station, to be due to differences in nitrifying efficiency. Sodium nitrate and ammonium sulphate corrected it.

The alkali soils at the New Mexico station were improved by leaching, but too heavy leaching removed plant food. Alkali spots at the Iowa station were reclaimed by draining and manuring. At the California station a 40-acre tract of strongly alkali soil, treated with sulphuric acid at the rate of 1 ton to the acre, produced 80 tons of barley hay. Untreated land produced nothing. Crude sulphur gave no beneficial results. Flooding, draining, and growing cover crops gave satisfactory results in reclaiming the niter soils of Colorado.

Irrigated plats of alfalfa at the New Mexico station did best when receiving the least amount of water at an irrigation, but most frequent irrigations per season. Irrigation was found to increase bacterial activity at the Utah station. At the Tennessee station all of the nitrates were leached out of the soil after one year to a depth of 2 feet, but none leached out at a depth of 6 feet. It was found at the Minnesota station that the movement of water ceases in coarse sand and peat soils when it is reduced to one and a half times the hygroscopic moisture. If the soil sticks to the auger its moisture content is higher than this. If it does not, the subsoil moisture is liable to be too low for the successful growth of plants. At the Missouri station it was found that the run-off of water on uncultivated land is about double that on cultivated land. Loosening of the soil was found to be more important for increased absorption than for decreased evaporation. At the Kansas station it was found that a cultivated surface was no more effective than a bare surface in checking soil moisture evaporation. Soil-leaching investigations under citrus trees at the Florida station show that the leaching of nitrogen decreases as the trees grow larger. The soil fixes phosphorus, which does not increase in the drainage water when applied on the surface. The amount of potash in the leach water gradually increased, showing that the soil had about reached its limit in its ability to fix this element. Soils that had received four times the normal amount of phosphoric acid showed four times as much phosphorus by chemical analysis as those receiving the normal amount.

Phosphorus was found to remain in the soil as a calcium salt and not in combination with iron and alumina. The Michigan station reports that the freezing point of soil is directly related to the moisture content; changes in the soil solution were found to serve as an index to the biological changes in the soil. Soluble salts moved from regions of high to low concentration rather rapidly in moist earth by means of diffusion, chemical reactions, and moisture movement.

The Kentucky station finds that the application of more than 200 pounds of sulphuric acid per acre was injurious. The gains from the use of small amounts were quite evident. The total sulphur in the plant was increased, the excess being mainly in the form of sulphates. The presence of sulphur and sulphates in the soil increased the protein content of alfalfa at the Arkansas station. Where ammonium sulphate had been applied at the Massachusetts station the sulphates of alumina, manganese, and iron were found in the soil. It was found at the Kentucky station that the small amount of barium contained in most soils did not affect the growth of plants, while manganese exerted a stimulating effect and may be essential in certain plants in the growth and development of the seed. Soils on the college farm at the Alabama station supported a vigorous nitrification and then became toxic to plants. They could be made sterile by applying ammonium sulphate or dried blood. They were found to contain considerable manganese sulphate which is toxic to plants. Lime corrected the condition. The chlorid and sulphid of magnesium were found to be harmful, while the oxid and carbonate were beneficial, at the Arkansas station. The Massachusetts station finds that neither aeration nor the application of lime increases the amount of potash taken up by plants, but the addition of organic matter did.

Vanillin and coumarin were found to be less toxic in soils than in solution by the Nebraska station. The toxicity disappears after a time in the soil. Quinone was found to be first toxic then stimulating. The toxicity of dihydroxystearic acid was corrected by liming. Carbonates were found to be less toxic in soils containing much organic matter at the Utah station.

Changes in temperature were found to be more rapid in dry than in wet soils at the Nebraska station. After 12 hours they were the same. A difference of 20° existed between mulched and unmulched soils at a depth of $3\frac{1}{2}$ inches. The Indiana station finds that soil temperature is a reflection of air temperature and cultivation has little effect. Rain has no marked influence on soil temperature and there seems to be no direct connection between soil moisture and soil temperature.

The New York Cornell station finds that the carbon dioxid increases in cropped soils up to full bloom of the plant and then begins to decrease. Treatment of the soil with carbon dioxid at the Indiana

station increased bacterial activity and plant food but also increased soil acidity and excluded oxygen. Soils at the South Dakota station continually cropped with wheat showed a loss of lime as carbonate, the magnesia remaining about the same as in virgin soils.

Studies on soil bacteria at the North Dakota station show that sugars and the fatty acids were available as sources of energy, the higher and more complex compounds being less so. The Utah station finds that the factors influencing bacterial activity in the soil were measured by the toxic action of various compounds, largely the electro-negative ions. Chlorids are the most toxic, followed by the nitrates, sulphates, and carbonates, respectively. Osmotic pressure of a salt solution added to a soil is a retarding factor, but the main factor appears to be the physiological action on the living protoplasm of the cell, changing its chemical and physical properties. At the New Jersey station soluble phosphates were found to stimulate bacterial and fungi activity in the soil to a remarkable degree. The addition of a little nitrate increased the activity in unlocking the food material in the soil and thus tended to hasten its exhaustion. The New York State station reports that bacteria in soils may be examined directly but special staining methods must be used on account of the difficulty of making suitable soil preparations. The most abundant bacteria in soils were found to be the nonspore-forming motile rods, the next being the Actinomycetes.

VETERINARY.

No causal relation was found by the Ohio station between the absence of iodine in the food and the prevalence of goiter. Its presence in food is comparatively unusual and accidental. The Washington station considers goiter to be due largely to unbalanced feeding.

The Kentucky station finds clover bloat of cattle to be due to the fermenting action of bacteria on the clover mass in the stomach. The amount of gas formed is in direct relation to the amount of sugar present.

Contagious abortion has been the subject of study by a number of stations. The Kentucky station prepared a bacterin that was quite successful for immunizing against this disease. Abortion in cattle is not caused by the same organism that causes it in mares. Methylene blue proved to be the best remedy. The Vermont station reports good results from the use of cresol compounds. At the Michigan station 27 per cent of the animals on farms where contagious abortion was prevalent had infected udders. Strippings were as high in cellular count and antibodies as the foremilk. The age of the cow was not a factor in the first appearance of the disease. Injection of infected milk into rabbits gave no results. The Arkansas station did

not find that treatment with methylene blue, carbolic acid, or lugol solution was entirely satisfactory. Bacterins gave encouraging results. The Connecticut Storrs station finds that agglutination and fixation tests were reliable, with few exceptions. Agglutination is the simplest and most practical. After animals have passed the first breeding period, chances of infection are small. All calves at birth give the same reaction as their mothers. The use of an infected bull is an important factor. At sexual maturity the readjustment of the organism subjects it to a strain that makes it prone to infection from any source. Infected milk at the critical time in the calf's development may be a fruitful source of infection.

Immunization for hog cholera with attenuated virus was successful at the Kentucky station. Attempts to attenuate hog-cholera virus through rabbits at the Indiana station were unsuccessful. Cholera blood dried by exposure to daylight at room temperature gradually lost its virulence. It was found to be unsafe to use the virus of tuberculous hogs for immunizing unless it was passed through a Berkefeld filter. The Oklahoma station finds that the vitality of virus varies. One sample lost it after 104 days, another after 28 days. Studies on the length of immunity showed that immunized hogs put in with sick pigs remained healthy for 40 days. Inoculation after 53 days caused cholera with some; others retained immunity for 82 days. They were more susceptible to inoculation than to exposure to sick hogs. The Arkansas station finds that the amount of attenuated material injected made considerable difference in the severity of the attack, the pigs varying greatly in susceptibility to the attenuated material. There was but little difference in the virulence of serum-free cells and virus cells not free from serum. Ninety-five per cent of pigs were immune to direct exposure to cholera as long as they were nursing their immune mothers, and 90 per cent were immune to injections of small quantities of virus. There was the same immunity in the second and third litter of pigs. They lost their immunity as soon as they were weaned. It is apparently imparted through the milk. At the Missouri station, in hogs treated with cholera-serum virus, infection in the blood ceased after the seventeenth day. Highly potent serum injected simultaneously with small doses of virus did not prevent the latter from multiplying enormously. The Massachusetts station believes it is possible to develop a race of hogs immune to cholera.

The Minnesota station finds that a combination of two or more tests for tuberculosis is much more accurate for diagnosis than a single one. The Washington station reports that the bovine and avian type of tubercle bacilli have been successfully grown on synthetic media and there is some success with bacteria isolated from human sources. The California station reports that tubercle bacilli

retained vitality for 140 days in soil around water holes, but not so long on surface soils. Earthworms act as distributors and carriers. At the Missouri station it was found that tuberculosis could be transmitted through the use of a serum from a hyperimmunized hog with tuberculosis. Bovine tuberculosis could be transmitted by blood inoculations to hogs and to a lesser degree to rabbits and guinea pigs.

Swamp fever was not found to be carried by the bot fly, at the North Dakota station, but the Wyoming station reports that it may be transmitted by the stable fly and possibly by other biting flies, as subcutaneous injections of very small amounts of infected blood by an infected needle, caused the disease. "Trembles," or milk sickness, is found by the North Carolina station to be caused by richweed, *Eupatorium ageratoides*.

The Wyoming station reports that sheep become infected with tapeworm from pastures. The Kansas station finds that the tapeworm of the dog, with the cotton-tail rabbit as intermediate host, also develops in young cats.

At the Nevada station an outbreak of hemorrhagic septicemia among cattle was controlled by a bacterin with good results. The Louisiana station finds that blood-sucking insects, as the horn fly and mosquito, are carriers of anthrax, but the organism does not pass through the insect, being killed by digestion.

On the diseases of poultry the Nevada station reports that contagious epithelioma appears to be due to a group of infections. Bacterins prepared from cultures were effective in its control. Bacterins were also prepared for fowl cholera, which protected against natural infection, but not against experimental inoculation. The Rhode Island station believes the disease is due to at least three organisms. It is not transmitted to the egg. The Kansas station reports that the organism causing roup is very similar to that of fowl cholera. In studies on white diarrhea at the Connecticut Storrs station, inoculations in the lower part of the oviduct always caused infection. There was no evidence that males transmit the disease, but they often give the reaction. Young birds before maturity do not give the reaction. Rabbits were killed by feeding them *Bacterium pullorum*, but guinea pigs and kittens were not affected. It requires cooking to kill the organism. The Rhode Island station believes blackhead of poultry to be due to improper feeding. Parasites supposed to be responsible for it are always found in both healthy and diseased fowls. It is present in the intestinal tract, and under favorable conditions, as chilling or improper feeding, diarrhea results, and the parasites multiply and invade the tissues.

INSPECTION OF THE STATIONS.

In accordance with the usual practice of the office, a personal examination on the grounds was made during the year of each of

the experiment stations receiving Federal funds. These official visits served as the means of securing a large amount of first-hand information in regard to the progress of the stations and their relations to the colleges with which they are connected and to the agriculture of the States, as well as for a detailed examination of their work and accounts; and the opportunity was embraced for conferences with the station officers in regard to organization and administration. This inspection was participated in by five members of the office force—the chief (E. W. Allen), Walter H. Evans, E. R. Flint, W. H. Beal, and J. I. Schulte.

The following reports upon the several stations are based on the results of this visitation, together with the annual financial statements of the stations, rendered on schedules prescribed by the Secretary of Agriculture, and the printed and other reports received from station officers.

ALABAMA.

Agricultural Experiment Station of the Alabama Polytechnic Institute,
Auburn.

J. F. DUGGAR, M. S., *Director.*

The station has actively entered the campaign for larger agricultural production and is taking a leading part in this work in close cooperation with the extension service and other agricultural forces in the State.

The station staff underwent some changes during the year. Dr. F. A. Wolf, the plant pathologist, resigned and was succeeded by Dr. G. L. Peltier. The station chemist, Dr. J. T. Anderson, died in February, 1917. His position was not immediately filled, which delayed some lines of work. Dr. G. C. Starcher, from the Virginia station, was appointed horticulturist. The station, aside from the Federal and sales funds, receives an annual State appropriation of \$22,000 for experiment work.

Adams fund projects.—Breeding experiments with cotton have been directed along the lines of the correlation of size of boll to earliness, and attempts to increase the length of fiber in strains which have been developed for productiveness and earliness. A new and valuable wilt-resistant strain of Cook cotton has been isolated, which is meeting with much success. Studies in corn breeding have resulted in finding some qualities of the ear that appear to be closely connected with yield. Similar work with oats was interrupted by the severe winter, which resulted, however, in finding two hybrids which withstood the low temperature and will be developed further.

Studies on the effect of some southern hog feeds on the properties of lard included a comparison of velvet beans and peanuts with corn,

fed singly and in combination. Sweet potato and Yokohama bean forage were also tried, but the latter was not relished by the hogs. Velvet-bean meal produced a firm, white lard, but the carcasses were a little darker colored than the corn-fed hogs. The cheapest pork was raised on peanut forage, the cost being \$1.75 per hundred pounds of gain, which sold at \$8.75 per hundred.

Interesting results have been obtained on the nitrification of compounds that are toxic in culture solutions. It was found that pyridin, quinolin, and guanidin carbonate nitrify in the soil and are therefore beneficial, although they are toxic in water solution. Apparently the nitrification goes on best the more acid the soil. Lime inhibits the nitrification. Salicylic aldehyde completely inhibits it and its presence in the soil should be regarded as injurious. Experiments to determine how long the effects of toxic bodies like vanillin, pyrogallol, coumarin, and quinolin may persist in the soil showed that all injury disappeared in two years. It was found that the disappearance of these compounds in the soil is due to microorganisms, and bacteria were isolated which decomposed vanillin, coumarin, and pyridin and one which broke up quinolin. There appear to be specific organisms for each of these compounds, which suggests the possibility of inoculating unproductive soils with suitable types of organisms to make them productive, provided the unproductiveness is due to the presence of the above compounds. Phosphates and nitrates seem to favor the decomposition of vanillin, possibly by making conditions more favorable for the bacteria.

Citrus-canker investigations have been directed toward attempts to isolate the organism from the soil, which have not been successful. In order to determine how rapidly the organism can penetrate the tissue, solutions containing it were sprayed on uninfected foliage. Under favorable conditions spots began to appear on the stems and leaves after 20 minutes. Cooperative work with the United States Department of Agriculture is being carried on in connection with this project to test the relative resistance to canker of various citrus species. The possibility of developing a resistant stock is of great importance.

Valuable information has resulted from studies on the rice weevil as a corn pest, which has done serious damage in the State. It is found that the weevils gather on the earliest maturing plot or field, hence this area can be used as a trap plot, the corn being gathered within six weeks after the roasting-ear stage, before the first generation can mature and emerge, the unhusked corn being fed at once. It was found best to husk the corn in the field, storing the ears bare, as the husks tend to retain the weevils rather than to exclude them as is generally believed. Sprinkling naphthalin on the corn helps to keep out the weevil and does not make the corn unpalatable. The

silos is strongly recommended for utilizing the refuse and stalks. It is believed that the employment of these methods would save the State \$3,000,000 a year, and a vigorous campaign is being conducted to secure the cooperation of the farmers in thus controlling this pest.

Tests on the efficiency of arsenicals in controlling the curculio, brown rot, and other troubles, as well as of their burning effect on the foliage, were somewhat interrupted by the death of the chemist. A decided difference was found, however, between the various preparations. Neutral arsenates produced more burning than the acid preparations, contrary to the usual belief.

Work with Hatch and other funds.—Experiments to determine the best rates of seeding peanuts indicate that the yield may be greatly increased by much thicker planting than is customary.

Considerable work has been done as to the best way and amounts of feeding velvet beans to dairy cattle. Large amounts of velvet-bean meal were found to be unpalatable to some cows. Soaked velvet beans and pods were found to be eaten as readily as the meal after the cows became used to it. Fed with corn silage it appeared to be very palatable. Two pounds of velvet-bean meal were found to be equal to 1 pound of cottonseed meal in producing capacity. In similar tests on fattening steers, in comparison of velvet beans in the pod and silage with cottonseed meal and silage, 1 pound of high-grade cottonseed meal was equal to about $2\frac{1}{2}$ pounds of the velvet beans. The velvet-bean steers brought a little higher price on the market than the others. Experiments on pasturing hogs on peanuts, using various supplements, resulted in saving about half the concentrated feed.

Some work has been done on field and storage rots of the dasheen. A new pecan disease was found that seems to gain entrance through wounds made by the borer and to cause serious damage to the tree. The native and Japanese persimmons, peach, pear, and plum appear to be susceptible also. No satisfactory remedy has been found as yet for the pecan borer, which appears to sour the sap and thus kills the cambium.

Some interesting results have been obtained from studies on the acid soils of the college farm. These soils support a vigorous nitrification, but when this has taken place they appear to be toxic to plants. They can be made practically sterile by adding ammonium sulphate or dried blood. An examination of these soils showed that considerable manganese was present and that nitrification apparently produced manganese nitrate, which is toxic when present in sufficient amounts. There was found to be no soluble manganese present in the soil unless there was a high percentage of nitrates. This probably explains the failure to get results from ammonium sulphate in some places in the State. Applications of nitrate of soda apparently do not produce this result. Lime corrects the condition.

Fertilizer experiments are under way to determine their influence on Satsumas injured by frost when applied at different periods of growth. A large number of investigations have been carried on with the sweet potato, including variety and fertilizer tests and methods of bedding and storage. Variety tests are also being made with all of the principal vegetables and fruits.

Studies on the relation of organic compounds to higher plants are being made by removing the tops from pea roots and growing the latter in nutrient solutions under sterile conditions. Results show that the top of the plant is the only source of the sugars. There is evidence that plants can secure a part of their carbon from the soil if it is present in a soluble or available form. Other lines of work include a study of cotton hybrids, distance and rate of seeding and fertilization of peanuts, the relative yield of different field crops per acre, studies of the oil content of soy beans, and tests of velvet bean and peanut meal for fertilizing purposes. Soy beans and peas are being tried with corn for silage, and sorghum silage is being compared with corn silage. A strain of wheat which is very productive and shows resistance to frost is being developed by the head-to-row method.

The publications received from this station during the year were as follows: Bulletins 190, Citrus Canker; 191 (Technical Bulletin 1), The Effects of Certain Organic Compounds on Plant Growth; 192, Cottonseed Meal Compared with Velvet Beans for Fattening Steers; 193, Peanuts—Tests of Varieties and Fertilizers; 194, Growing Peanuts in Alabama (a popular edition of Bulletin No. 193); Circular 35, Annual Report of the Director of the Experiment Station on Work Done Under the Local Experiment Law in 1916; and the Annual Report for 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$14,757.03
United States appropriation, Adams Act.....	15,000.00
Balance from United States appropriation, Hatch Act...	242.92
State appropriation, including balance from previous year.....	28,831.46
Farm products.....	648.24
Miscellaneous.....	3,429.64
Total.....	62,909.34

This station is making a good showing in its work and is exerting a large and growing influence in the State.

ALASKA.

Alaska Agricultural Experiment Stations, *Sitka, Kodiak, Rampart, and Fairbanks.*

C. C. GEORGESON, D. Sc., *Agronomist in Charge, Sitka.*

The spring of 1917 was one of the most unfavorable for crop production throughout all Alaska that has been experienced in the history

of the stations. Not only were the daily mean temperatures unusually low, but the rainfall was unfavorably distributed. In the interior there was a deficiency of rainfall until July, after which there was an excess which tended to retard the development of grain crops. Notwithstanding the unfavorable conditions, the grain matured, the frosts having held off until well into September.

During the year an addition was made to the headquarters building at Sitka for use as a library, and a small cottage was erected on the station farm. An 8-16 horsepower tractor and a new thrashing machine were added to the equipment of the Fairbanks station.

J. W. Neal, who had been in charge of the Fairbanks station since work was actively begun at that place in 1908, resigned and was succeeded by M. D. Snodgrass, who for about 10 years had been in charge of the stock-breeding station on the island of Kodiak. T. D. Crippen, who was assisting with the work at Fairbanks, left June 14, 1917. He was succeeded by W. T. White, a graduate of Kansas Agricultural College, 1917.

In making appropriations for the Alaska station Congress authorized the establishment of an experiment station in the Matanuska Valley. A site was selected $1\frac{1}{2}$ miles from Matanuska Junction, and F. E. Rader, a graduate of Kansas Agricultural College, who had been with the Alaska stations at Sitka and Rampart from 1900 to 1907, was selected to do the pioneer work in establishing the new station. A cottage and barn were erected and about 12 acres was prepared for cropping in 1918. The lines of work to be taken up at this station are similar to those at the other stations in adapting agriculture to the local conditions.

The Sitka station continues to devote most of its attention to horticultural work. Small fruits are being extensively experimented with and a number of hybrid strawberries have been produced, some of them being exceedingly promising. Considerable work is being done with vegetables and a number of seedling potatoes are being grown that have given excellent yields. A considerable amount of nursery stock is produced, more than 11,500 trees, bushes, and other food-producing plants, and over 1,600 ornamentals having been available for distribution during the past year.

At the Fairbanks station especial attention is given to grain growing, and more than 1,240 bushels of spring wheat, oats, and barley were produced last year. Most of this grain is from pedigreed strains developed at the Fairbanks and Rampart stations. The experiments with alfalfa have shown that most varieties except those of *Medicago falcata* winterkill at Fairbanks. In attempts to produce hay, attention is given to growing red clover as an annual crop, and excellent results were secured last year from clover seeded May 12, which gave a dense stand 24 to 30 inches tall in September. Potato growing and

turnip seed production are being developed, the station producing considerable quantities of Petrowski turnip seed for Alaska distribution.

The Rampart station is continuing its grain-breeding investigations, having a number of wheat, rye, barley, and oat hybrids, as well as strain selections of the more important varieties, under observation. This station has also continued the testing of alfalfa, but with the exception of varieties of *Medicago falcata* and a strain of Grimm alfalfa, most of the alfalfas have winterkilled. Several varieties of field peas have proved adapted to Alaskan conditions, and among the clovers *Trifolium lupinaster* has been found to be hardy, to produce good crops of seed, and to be well adapted to soiling though not very valuable as a hay crop. A number of hybrid strawberries produced at the Sitka station have been tested at Rampart with satisfactory results.

At the Kodiak station the work with cattle and sheep has been continued, five head of Holstein cattle having been added to the herd during the year. Reciprocal crosses will be made between these and the Galloways in order, if possible, to produce a strain of cattle with the hardiness of the Galloway but with some of the milking qualities of the Holsteins. Tuberculosis has developed in the Galloway herd and the reacting animals have been segregated and are being used to build up a new herd, the Bang method being followed.

The only publication of the station during the year was the annual report.

The income of the station during the past fiscal year was as follows:

United States appropriation-----	\$48,000.00
Miscellaneous-----	2,451.20
Total -----	50,451.20

In the development of Alaskan agriculture the Alaska stations during the past year continued to play a highly important part. The stations' work, which is followed quite closely, is helping to solve the food and feed-supply problem and to bring about a greater reliance on home resources and local production.

ARIZONA.

Agricultural Experiment Station of the University of Arizona, Tucson.

R. H. FORBES, Ph. D., *Director*.

The station engaged vigorously in the campaign for increased agricultural production with very encouraging results. A few changes have taken place in the staff. G. F. Freeman left for the year to pursue advanced studies, and J. F. Nicholson, the agronomist,

resigned to accept a position as extension director in Arkansas. Several minor members of the staff have gone into military service.

The State appropriations for the year were \$35,526.61, part of this being appropriated for specific purposes.

Adams fund projects.—The tepary bean, which the station discovered and developed, has proved to be a distinct contribution to Arizona agriculture. The food-shortage conditions resulted in extensive plantings of this bean through the Southwest. Various strains have been developed, of which White No. 17 promises to be one of the best. Long-standing selection experiments with alfalfa are resulting in distinctly superior strains. Wheat-breeding experiments have yielded a number of hybrids, some of which appear to be hard-milling wheats of good quality that will remain hard under southwestern climatic conditions. Papago sweet-corn breeding has proved it to be not only of value as a table corn, but unexpectedly it has proved to be a superior silage corn because of its fine stalks and heavy yields under arid conditions. A study of the tolerance of crops to alkali shows that this does not coincide with the amount of alkali present, and is evidently due to some concomitant condition which is being worked out. It is hoped that some means of mitigating the effects of such salts upon plant life will result.

Date processing and marketing studies have been continued, especially with reference to the construction of suitable machinery for the ripening, pasteurizing, and curing of dates for the market. Nearly all varieties of fresh dates may be placed in dry cold storage, kept so for as much as a year, and then marketed in prime condition. Attempts are being made to breed Deglet Noor dates true to seed. The first generation of seedlings is producing its first crop of fruit this year, which will now afford material for study.

A very important study is being made of the underflow and ground water in the vicinity of Casa Grande, which is the center of a fertile region of considerable extent. The effect of increased pumping is a gradual exhaustion of the underground supply, and attempts will be made to recharge this from the Santa Cruz River and from flood waters. In connection with this study, types of pumping machinery and costs of pumping have received attention.

The station possesses 14 mature and 5 young ostriches which are used for the purpose of studying feather production, feeding, and life history. Crosses between the South African and Nubian varieties have been secured.

Studies relating to the factors influencing hardiness in typical southwestern plants, include the olive, Eucalyptus, and citrus, but have been largely directed to the cacti. The San Saba prickly pear is spineless, extremely drought resistant, and very hardy, and it is to be tried under range conditions. This promises to be of consider-

able importance as during severe winters the native cacti freeze back. The Burbank and other cultivated spineless cacti grow rapidly but are not hardy. The species of spineless cacti having thick-walled outer integuments are more resistant to cold than thin-skinned varieties. The freezing point of the cell sap was found to be very little below that of pure water. The plant will withstand freezing of water in the intercellular spaces and apparently suffers no injury from the consequent concentration of the sap. Some species will stand a temperature of -15° F. if not too long continued, while others are injured at -5° F. This difference is believed to be partly due to differences in the character of the protoplasm.

Work with Hatch and other funds.—Plant introductions and selection, with special reference to varieties adapted to southwestern climatic conditions, have resulted in finding a native currant that produces an excellent fruit, is a great bearer, and is very ornamental. Two varieties of Tamarisk were found which gave promise of considerable economic value for windbreaks and ornamentals. Varieties of native Arizona walnuts have also been found which are worthy of cultivation. Some work has also been done with roses and other ornamentals. Studies of the flora of the State, with special reference to economic values, are about completed.

The occupation of the new farm near Mesa gave opportunity for experiments in the eradication of Johnson grass, the methods used being continuous dry fallow, winter crops and summer fallow, summer crops and winter fallow, and grazing by sheep. This has given interesting information as to the cost and efficiency of the different methods employed. Bare fallow, which is the usual method, costs about \$30 an acre for the first year and \$15 for the second. This farm is now divided into plats and is utilized for cultural, fertilizer, and selection experiments with various standard crops, especially alfalfa, wheat, barley, oats, Indian corn, cotton, Colorado stock and Canada field peas, beans, milo maize, and Sudan grass. The last has proven to be very successful in this State especially as supplementary to alfalfa during the hottest months, and to take over worn alfalfa fields by disking it in. It is also grown in combination with soy beans and cowpeas. Egyptian cotton is being grown to some extent, but is quite badly attacked by root rot. The region is an exceptionally fine one for lettuce. After the main crop is removed the remainder is used for feed for sheep and chickens.

Selection for the improvement of varieties of silage crops is being carried out, including feterita, Kafir corn, and sorghums. The value of silage in carrying poor range stock over the annual period of feed shortage has been demonstrated. The growing of lettuce as a winter rotation crop with cantaloups is being successfully introduced. Grasshopper control under range and irrigated farm conditions is receiv-

ing attention, this constituting the most serious pest which the Arizona farmer has to combat.

Considerable work is being done with sheep on crosses of Tunis with Merinos, Shropshire, and Hampshire. A combination of crosses with native ewes has been secured that gives a combination of the mutton form with a good clip of wool, but no improvement has been secured over the pure-bred Hampshires.

Miscellaneous crop tests and demonstrations have been carried on at the dry farms near Prescott and Cochica. The most successful crops thus far developed in these localities are the grain sorghums, Sudan grass, tepary beans, certain quick-growing varieties of Indian corn, and potatoes. It has been shown that in representative localities these crops may be grown as a profitable source of silage supply, in which form they will supplement the range.

Silage feeding tests were carried on at the dry farms, particularly with the view of demonstrating the value of silage in carrying poor range stock over the annual period of food shortage in this region. This work has yielded very encouraging and valuable economic results.

The following publications were received from this station during the year: Bulletins 77, Practical Fig Culture in Arizona; and 78, Relation of Weather to Crops and Varieties Adapted to Arizona Conditions.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$14,999.95
United States appropriation, Adams Act.....	14,995.61
Balance from United States appropriation, Hatch Act..	.95
Balance from United States appropriation, Adams act..	4.39
State appropriation, including balance from previous year	35,526.61
Farm products, including balance from previous year..	11,955.40
Total	77,482.01

The station continues to be an active force for the advancement of agriculture in the State and is devoting itself in a systematic and thorough way to leading questions. The diversity of conditions in the State gives its work a wide range.

ARKANSAS.

Arkansas Agricultural Experiment Station, *Fayetteville*.

MARTIN NELSON, M. S., *Director*.

The general condition of this station is satisfactory, and with the increased income that it will soon receive from a millage tax its sphere of usefulness will be still further enlarged. The biennial

appropriation in which the station shares was \$49,000. A substation was established with State funds at Scotts, and its maintenance provided for.

Two large concrete silos were built for experimental purposes. Some changes occurred in the staff. J. L. Hewitt resigned from the head of the plant pathology department to become inspector for the State plant board and was succeeded by J. A. Elliott of the Delaware station. G. L. Caldwell, veterinarian of the station, left to accept a commission in the Army. Other changes occurred among the assistants, and the places of those leaving were satisfactorily filled.

Adams fund projects.—Investigations on the effect of magnesium and sulphur in soils on the composition of plants rich in protein or fat are in progress with cotton, peanuts, and soy beans grown in in glass jars. Preliminary results showed that magnesium chlorid and sulphid were injurious, while the oxid and carbonates were beneficial. Sulphur and sulphates increased the protein content of alfalfa. Considerable work has been accomplished and some results published on the nature and assimilability of the organic phosphoric acid compounds in cottonseed meal and other feeding stuffs. The work on the inosite phosphoric acids of cottonseed meal was completed and was confirmed by the results obtained with wheat bran, Kafir corn, and corn. This work is being continued with oats, rice bran, and wheat shorts. A method for the determination of phytin phosphorus in plant products was perfected.

An organism was isolated from lesions of the apple ring rot which proved to be *Sphaeropsis malorum*, which causes the common black rot of apples, manifesting itself in rather an unusual manner. Studies on cotton-boll shedding indicate that it is a phase of the angular leaf disease due to *Pseudomonas malvacearum*.

Studies on the winter and summer host plants of the apple woolly aphis were continued. Colonies which were originally established from spring migrants were carried on apples through the season, getting the fall migrants in September and October. Efforts to get these migrants to deposit the young on the apple, hawthorn, and elm were unsuccessful. The hawthorn seems to be resistant to the winged forms to a remarkable degree. It does not appear to be easy to transfer the aphis from the apple to the hawthorn or vice versa. It is believed from breeding experiments that there is an average of 12 young produced. It was found that adults of the apple-tree borer would feed on fruit and under abnormal conditions would even deposit their eggs in fruit. The larvæ were found to be able to live for a considerable time in the apple, suggesting that they might be reared to maturity in the fruit. Experiments indicate that in the Ozarks it has a

two-year life cycle instead of three years, as is commonly supposed. Many points in the life history have been worked out.

Researches on the subject of hog cholera have been along the line of complement fixation and agglutination in the diagnosis, the standardization of serum and methods of immunization by means of serum-free blood cells attenuated by physical and chemical means. Extracts were prepared from various organs, as the liver, spleen, and lymph glands. No antigen has been demonstrated in these. Different strains of virus vary in their virulence after attenuation. The quantity of attenuated material injected made considerable difference in the virulence of the attack. Pigs were found to vary greatly in their susceptibility to attenuated material, injection in some cases apparently causing a chronic cholera. Defibrinated blood from normal pigs did not cause any rise in temperature as compared with attenuated virus. There is but little, if any, difference in the virulence of serum-free virus cells and virus cells which were not free from serum. The bacterial flora of the intestinal tract of the normal hog in relation to hog cholera is being studied.

From the preliminary data obtained from a study of xenia in apples it appears that the characters of the pistillate plant are dominant in the progeny. Such characters as size, color, weight, yield, shape of flower, and texture have been considered. Over 3,000 pollinations were made, but on account of unfavorable conditions only a few fruits were set.

Considerable work has been done on cotton breeding, which is still in progress and promises some interesting results. Work is also being done on the effect of methods of harvesting and storage on the vitality of cotton seed.

A study of the factors governing the availability of rock phosphate in acid soils has been in progress with pot cultures, with two types of acid Arkansas soils and a peat soil, growing corn as a crop, rock phosphate in combination with lime and manure being added in varying proportions.

Work with Hatch and other funds.—Arsenate of lead has been shown to poison adults of the round-headed apple-tree borer. The conclusions arrived at in the study of its control are that the protection offered by white-lead paint is not commensurate with the cost. Paper wrappers and wooden veneers appear to be impracticable. The cost of screening is too great to warrant its use as a protection. Asphaltum showed a protective efficiency of 82 per cent. The most practical method of handling the borer is by pruning the trees in August and early September. Most of the proprietary compounds for controlling the apple and peach tree borers were found to be worthless, and the sealing of tree collars about the trees has been of no apparent advantage. The practicability of using the blast lamp for

destroying eggs and young is being tested, also the possible value of nicotin sulphate and resinate applied to the tree. Varieties of apples are being tested for resistance to borers. None of the protective measures against the peach-tree borer proved to be very effective.

Some interesting results have been obtained from a study of the immunity of suckling pigs to hog cholera. Data were secured on 24 sows and their litters. Of these, 93 per cent of the pigs were found to be immune to direct exposure as long as they were suckling immune mothers and 90 per cent were immune to the injection of small quantities of virus for the same period. Similar immunity was observed in the second and third litters of pigs, and it is believed that this immunity holds as long as the dam herself is immune. As soon as the pigs were weaned they appeared to lose their immunity. The immunity appears to be imparted through the milk. The treatment of contagious abortion with methylene blue, carbolic acid, and lugol solution were not entirely satisfactory with either of the remedies. Bacterins yielded some encouraging results.

Extensive studies of the Irish potato have included some 70 varieties, attention being given to classes and types. Variety tests of strawberries were made of the standard and everbearing varieties. The everbearers began to ripen fruit in July and continued to produce until freezing weather in November. One hundred and sixty-five varieties of grapes are under observation which promise definite results as to their respective merits. Variety tests of beans and cowpeas were emphasized as a war measure to determine their adaptability to Arkansas conditions as a nonperishable food product and the desirability of substituting certain varieties for other crops as an emergency measure. Other variety studies included asparagus, peaches, cherries, pears, and apples. Data have been collected on the blooming period of apples in northwestern Arkansas. Many varieties tend to be self-sterile and the information secured will indicate what varieties to plant together to secure cross-pollination.

The agronomy department has been experimenting on corn breeding to secure strains resistant to molds, fungi, and other diseases and the attacks of parasites and to increase the yield and adaptability to conditions in the State. Other experiments with corn have been conducted on frequency of cultivation, depth, length of cultivating period, distance of rows, rate and date of planting of varieties of different types, and methods of harvesting. Variety and cultural tests are also in progress with wheat, rye, winter and spring oats, and barley. Phosphates have not shown very marked effects on the station plats. On the plats receiving no nitrogen the winterkilling of grain was severe.

The central and branch stations have cooperated with farmers throughout the State in a comparison of annual forage crops, includ-

ing cowpeas, soy beans, velvet beans, peanuts, millets, Sudan grass, and sorghums. Suitable varieties for hay and grazing purposes for swine are being studied; also pasture and meadow crops, particularly clover for pasturage and hay. Fertilizer experiments to determine the amount of manure necessary to maintain a productive condition of light or thin upland soils, whether this will be profitable, and the relative value of different methods of fertilization with different crops and rotations, as corn, wheat, oats, and peas are in progress. A soil survey under a State appropriation of \$5,000 has been begun, together with a study of the acid soils of the State. In general, upland soils and those in the creek bottoms are said to be quite acid, while those in the river lands are not.

In a comparison of legume hay and tankage as supplements for corn in feeding brood sows, the lot receiving soy-bean hay and corn made the cheapest gains and those receiving alfalfa hay and corn made the best pork, but at a higher cost. Self-fed swine made 100 pounds of gain at less cost, the daily gains were greater, and the animals were more fully finished than by the usual method of feeding. Results of feeding rice bran and other rice by-products to swine showed that they tend to produce a soft, oily pork. Both Kafir corn and ground feterita gave better results in daily gain, in feed necessary for 100 pounds, and in the cost of gain made than did corn chops, all lots being fed on the same protein supplement.

The relative merit of different breeds and strains of poultry for egg production has been studied. The relation of the age of the hen to egg production showed considerable variation, some individuals showing a decrease in egg production the second year; others not. Cottonseed meal compared with meat scraps for laying hens showed the superiority of the latter, the difference being quite marked. The cost per dozen was about 3.6 cents less with meat scrap.

A plant-disease survey in cooperation with the Bureau of Plant Industry, United States Department of Agriculture, has so far revealed about 75 diseases existing in the State. The effect of hardness of water upon the settling or precipitation of the materials composing spraying compounds is being studied.

Food substitutes and their method of preparation have received attention, such as boiled rice, rice flour, boiled soy beans, soy-bean flour, cottonseed flour, corn meal, and barley to replace wheat flour.

The veterinarian of the station has charge of the hog-cholera control work, the serum plant, and the cattle-tick eradication in connection with the United States Department of Agriculture. A number of outbreaks of anthrax, blackleg, and other contagious diseases were successfully checked. The entomologist of the station has been relieved of the nursery inspection of the State, although still a member of the plant board.

The following publications were received from this station during the year: Bulletins 123 (with technical edition), The Relation of Fruit Growing to Soil Fertility; 126, Live Stock Sanitary Laws of the State of Arkansas—State Laws and Regulations of the Board of Control—Notes on these Laws and Regulations; 127, Farm Sanitation; 128, Fattening Swine on Rice By-products; 130, Corn Variety Tests, 1915 and 1916; 131, The Inosite-phosphoric Acids of Cottonseed Meal; and 133, The Digestibility of Some Arkansas Feeds for Hogs.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation.....	24,500.00
Fees.....	1,104.70
Sales.....	840.25
Miscellaneous.....	327.06
Balance from previous year.....	19,901.14
Total	76,673.15

The work of the station is developing in a very satisfactory manner. With the increased income in the future from the millage tax the outlook is very promising.

CALIFORNIA.

Agricultural Experiment Station of the University of California, *Berkeley*.

T. F. HUNT, D. Agr., D. Sc., *Director*.

The large amount of both scientific and practical work accomplished by this station is made possible by liberal State support, which is amply justified by the results.

On the outbreak of the war a conference was held of all the staff members to arrange to concentrate on emergency work by the temporary suspension of less important and urgent projects. About a dozen emergency projects were put in immediate operation, but these have not interfered with the more important lines of research that are being carried on.

The investigational work of the institution receives from \$150,000 to \$200,000 support from the State, this being the amount used from the total appropriations to the department of agriculture. Direct appropriations were made for a new creamery, animal husbandry building, water supply and repairs at Davis amounting to \$140,000, and for extensions at Riverside of \$50,000. Hilgard Hall, for the use of the agricultural department, was completed at a cost of about \$375,000 and was occupied by some of the station divisions. At the citrus experiment station, laboratory buildings at a cost of \$100,000 and smaller buildings, including the residence of the director and

that of the superintendent of orchards, at a cost of \$25,000 were added.

Few changes in the staff occurred. A. V. Stubenrauch, head of the division of pomology, died in February, 1917. A number of men in minor positions resigned to enter Government service in connection with the war.

The station has a large amount of cooperative and demonstration work in progress in various parts of the State with the Federal Government, State and local organizations, individuals, and other agencies

Adams fund projects.—Soil studies have been a prominent line of investigation, and various projects are in progress in this connection. On the alkali-soil phase of this subject the work has been largely on the effect of sulphur when added to such soils. A 40-acre tract of strongly alkali soil at Kearney Park, treated with sulphuric acid at the rate of 1 ton per acre, produced 80 tons of barley hay, the untreated soil producing nothing. Crude sulphur gave no beneficial results, no oxidation apparently taking place. From studies of the effects of salts of the heavy metals on plant growth it appears that the salts of smelter wastes, so far from being dangerous to crops, may actually be very stimulating, except in the case of arsenic.

Bacteriological soil studies have occupied a prominent place in the station work, and many phases of this problem have received extensive study, many of the results having been published. Portions of the work are practically completed, as the seasonal variations in the nitrifying powers of California soils and studies on the bacterial flora of California soil columns. The cause of spotted growth in grain fields is believed to be due to differences in nitrifying efficiency, the difference being from six to eight times between good and bad spots in a field. The application of nitrate of soda or sulphate of ammonia corrected the condition, and an active campaign is in progress to extend this information, which may prove an important factor in the grain yields of the State. A study of the connection of bacterial activity in the soil with dieback and mottle leaf of citrus has led to the conclusion that nitrification is an important factor in this trouble. Observations on the cause of the superiority of ammonium sulphate over sodium nitrate indicate that it is probably due to the sulphur. The water requirements of lemon trees are being studied by means of cylinders.

The intradermal test for tuberculosis in guinea pigs gave as satisfactory temperature reaction as the subcutaneous test when equal amounts were injected. The project on the causes and means of prevention of the spread of tuberculosis in cattle and hogs has been actively prosecuted. Range conditions as to excrement, water, and dust are maintained in a field on which the animals are exposed.

Studies of water holes and soils show that the organism can survive for at least 140 days in the water holes, but not so long in the surface soil. The length of time the organism can retain its vitality in the soil is being investigated. It was found that earthworms act as distributors and carriers. Various disinfectants have been tried, especially chlorin compounds. The control work has been done in cooperation with various live-stock owners.

Investigations of cyanid gas as an insecticide have been along the lines of a method of producing a gas of known strength, a method of testing air containing cyanid, and its action on insect eggs.

The department of plant pathology has been particularly engaged in a study of curly leaf of the sugar beet. This is believed to be due to an organism not yet discovered that is spread by a single species of *Eutettix*. *Eutettix* from greasewood can not cause the disease until after they are fed on infected beet leaves for some time. Some other plants will acquire symptoms of the disease if exposed to *Eutettix* from diseased beets. It is suspected that the disease is caused by bacteria.

A large amount of work has been done on the *Nicotiana* hybrids, nearly 4,000 plants of the eighth generation being under observation. A statistical study of the data obtained from a large number of measurements is being made.

Work with Hatch and other funds.—Some emergency work on feeding city garbage to hogs is under way, particularly on the effect of the presence of sodium carbonate. It was found that 1 ounce caused an appreciable effect and 2 ounces were usually fatal when fed alone, but no effect was observed when the carbonate was well mixed with garbage.

Investigations on the effect of cropping on the soil solution and of various concentrations of nutrients when applied to soils are in progress, large jars being used for this purpose. As an emergency project considerable attention has been given to possible sources of potash. The tule plant and redwood ash from sawdust and other waste material contain a high percentage of this element.

The physical and chemical analyses of a number of subtropical fruits have been made, among others the oil of the avocado, which averages about 20 per cent. The digestibility of avocado fat has been found to be about equal to butter. Studies have been made of California rice and its by-products in comparison with Japanese rice. Considerable attention has been given to publicity work on foods.

Grasshoppers were reported as serious in some portions of the State, and control measures involving the use of hopperdozers and poisons were put into effect. A mosquito survey in relation to the occurrence of malaria was made, the expense being borne by the State board of health, and the station cooperated with the War

Department in the control of mosquitoes about the various Army camps in the State.

Experiments on the control of the walnut blight with sulphur and tobacco dust applications were not very successful for this purpose, but aphids were almost completely eliminated.

Fertilizer experiments to secure increased production of grain have given excellent results. Nitrogen seems to be the limiting factor, and the application of 200 pounds of sulphate of ammonia per acre gave an increase of 100 per cent in the amount of grain. Rotation systems for the different sections of the State are being worked out. The acreage of beans planted has increased over 100 per cent for the past year. Experiments have been carried out with reference to the varieties desirable for specific localities. The growing of hemp and other fiber plants has been studied, also Egyptian cotton, which has been grown with success at Fresno.

A study is being made of the June drop of navel oranges. This is considered to be due to extreme variation in transpiration between day and night, coupled with the attacks of a fungus. The Valencia varieties do not appear to be so subject to the drop. This trouble has caused severe losses in the State. A number of seedling dates are being grown, the origin of which is definitely known. The propagation by offshoots could not be carried out owing to lack of material. Some work has also been done on the fig and pomegranate and on seedlessness in oranges.

Experiments in the field of genetics have been carried on with various plants. Tarweed (*Hemizonia* sp.) and *Crepis vireus* are especially valuable for this study, the latter on account of the small number of chromosomes which it contains, making the problem of linkage a simple one. The breeding of rust-resistant grains has been begun, also work with timothy, rye grass, potatoes, corn, walnuts, and various fruits. More than 400 varieties of grape are under trial, both native and foreign, in which connection experiments are carried on in pruning, spraying, and irrigation.

Some emergency work in food production was undertaken, particularly in canning without sugar or using grape sugar as a substitute, in drying, and preserving with salt. The temperature relations of *Bacillus botulinus* in canned goods were studied in cooperation with the State board of health.

Studies of irrigation practices in California orchards, overhead irrigation, the duty of water for rice and vineyard, and field crop irrigations were made.

The agronomy work at the Davis substation consists of variety and cultural experiments with wheat and barley, methods of preparation of the land, and rate and time of seeding. Dry-land rotations are being extensively tested. Considerable work has been un-

dertaken with grain sorghums, a large interest in these crops having been developed in the State. Milo maize, durra, and feterita do very well. The optimum irrigation requirements of alfalfa have been found to be 30 inches. For the production of a grain crop in this region about 18 inches of rainfall is required. In pot experiments with alfalfa the amount of water required per pound of dry matter was found to increase with the age of the plant. Pruning experiments with orchard trees were conducted, preliminary observations indicating that peaches and apricots are ordinarily pruned too heavily.

The dairy department has been concerned largely with problems of cheese making, using pepsin as a substitute for rennet. It is claimed that pepsin produces a drier cheese than rennet. The relation of pepsin to gas production in cheese and to flavor has been studied, pepsin cheese being considered a little sharper than that made with rennet. The use of *B. bulgaricus* cultures for the California type of granular cheese is being tested.

The agricultural engineering department has prepared blue-print plans of farm buildings, which are in great demand, over 5,000 sets having been sent out during the year. Dairy buildings combining the best features of existing structures and approved by the State board of health have been planned and about 40 have been erected over the State. An electric tractor for use in gardens has been built and a dynamometer devised for measuring the power used in plowing.

The data obtained in poultry investigations show an apparently large increase in egg production where electric lights were installed in the hen house. In experiments in feeding hogs various rations were tested, also the use of the self-feeder, and substitutes for barley. Milo maize has proved very good for this purpose and coconut meal fed to the extent of 25 per cent in place of barley gave good results.

Long-time feeding experiments are being conducted with the dairy herd and with beef cattle to determine the time of year and the proper age at which to remove them from the range. Some experimental work is also being done with sheep, comparing two clippings with one annual clipping, the value of old ewes, and the cost of lamb production from birth to the time of weaning.

The following publications were received from this station during the year: Bulletin 270, A Comparison of Annual Cropping, Bien-nial Cropping, and Green Manures on the Yield of Wheat; 271, Feeding Dairy Calves in California; 272, Commercial Fertilizers; 273, Preliminary Report on Kearney Vineyard Experimental Drain; 274, The Common Honeybee as an Agent in Prune Pollination; 275, The Cultivation of Belladonna in California; 276, The Pomegranate;

277, Sudan Grass; 278, Grain Sorghums; 279, Irrigation of Rice in California; 280, The Economical Irrigation of Alfalfa in Sacramento Valley; Circulars 152, Some Observations on the Bulk Handling of Grain for California; 153, Announcement of the California State Dairy Cow Competition, 1916-1918; 154, Irrigation Practice in Growing Small Fruits in California; 155, Bovine Tuberculosis; 156, How to Operate an Incubator; 157, Control of Pear Scab; 158, Home and Farm Canning; 159, Agriculture in the Imperial Valley—A Manual for Settlers; 160, Lettuce Growing in California; 161, Potatoes in California; 162, Bacillary White Diarrhea or Fatal Septicemia of Chicks and Coccidiosis or Coccidial Enteritis of Chicks; 163, Some Fundamental Considerations Affecting the Food Supply of the United States; Memorandum Prepared for the Committee on Resources and Food Supply of the State Council of Defense; 164, Small Fruit Culture in California; 165, Fundamentals of Sugar-beet Culture Under California Conditions; and the Annual Report for 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation	120,281.18
Individuals	575.00
Fees	6,862.91
Sales, including balance from previous year.....	47,109.28
Miscellaneous.....	33,749.72
Total	238,578.09

The California station, with its liberal resources, is carrying on a large amount of research that is of fundamental importance to agriculture. It promptly responded to the call for emergency work and is doing its full share in this without seriously crippling its established lines of investigation.

COLORADO.

Agricultural Experiment Station, Fort Collins.

C. P. GILLETTE, M. S., *Director.*

There were no changes in the staff among those in charge of investigational work, but two or three assistants were lost to other institutions or to the war. The work underwent no serious interruptions and good progress was made along the lines in which the station has been engaged.

No new buildings of consequence were added during the year, but the prospects for the future are most encouraging, the State aid being

materially increased by a millage tax provided for by the legislature, from which the station will receive from \$45,000 to \$50,000 annually, or an annual increase of about \$12,000 over what has been received. It is believed that in about 10 years a building fund of \$1,000,000 will be available for the institution, which will permit of extensive improvements. Provision has also been made for an engineering branch to be placed under a vice director. An appropriation of \$5,000 was made for the drainage project at Grand Junction, and \$1,500 was supplied for an investigation of the utilization of fruit juices. In addition to this, \$10,500 is provided for cooperative work with the United States Department of Agriculture in horse breeding, irrigation investigations, and alfalfa-seed production.

Adams fund projects.—The study of Colorado wheats has been in progress for six years. These wheats were found to contain large percentages of nitrogen and true gluten. The ratio of gliadin nitrogen to glutenin nitrogen was well within the limits accepted for good flours. Wheat grown under dry-farming conditions was not superior to that grown under irrigation. The determining factors in the wheat crop are the distribution of rainfall, cloudiness, resistance to rust, and the stage of development of the plant if attacked, temperature, and soil fertility. The character of the grain is easily influenced by the composition of the soil, the nitric nitrogen bearing a direct relation to the nitrogen content of the grain and plant. Rust inhibits the transfer of material to the seed, which occurs just before maturity, and causes a marked depression in the protein content of the grain. Milling and baking tests were made of all samples.

Studies on the reclamation of niter soils will be continued. Serious outbreaks of niter troubles have occurred in certain sections of the State, which will be investigated. Studies of the Rio Grande waters have been completed and published.

Investigations on the stem blight of field and garden peas showed it to be caused by *Pseudomonas pisi*, which enters the host through the stomata or mechanical injuries, causing a watery, olive brown discoloration in the stems and leaflets. Resistant varieties are the most satisfactory remedy, and later planting than usual reduces the amount of injury. The disease was not very prevalent during the past year. Some work was done on nitrogen fixation in alkali soils in which temperature as a determining factor in bacterial activity was noted. The effect of green manuring on bacterial activity was found to be somewhat inhibitory, supposed to be due to the increased acidity of the soil solution. One species of nitrifying organism has been isolated and grown in pure culture.

The agronomy department has been studying the relation of soil moisture, structural development, and yield of small grain by means of potometers and small boxed plats in the field. Preliminary ex-

periments indicate that the critical period for wheat is from 10 to 20 days before heading. One good irrigation at this time gave results equal to those secured from two or three irrigations before or after this period. Work on irrigation has been largely confined to testing the various forms of water meters to detect errors. The Venturi flume is one of the results of the irrigation studies.

The entomological department has been working largely on plant lice, attention being paid to life-history studies to discover the habits of species having alternate host plants. Two species which alternate between the cottonwood and beet and the cottonwood and turnips are receiving special attention. Other subjects investigated have been the species having willows for their winter host plant, the migratory habits of the currant-plant louse, and some species of the woolly aphid.

Work with Hatch and other funds.—Considerable field work has been done on the habits of the codling moth. The data obtained will be used in attempting to find methods for its control. This work is being done largely in cooperation with the Bureau of Entomology, United States Department of Agriculture. Two or three severe outbreaks of grasshoppers were reported during the year, the use of arsenic bran mash proving an effective means of control. Some work has been done on the life history of *Syrphus* flies. The alfalfa weevil was introduced into the western part of the State, evidently in feed-stuffs, and several square miles became infected. Warnings were immediately issued and the possibility of quarantine measures to prevent its spreading to the eastern part of the State, where alfalfa growing is of great economic importance, is being considered.

Very complete observations have been made on the subject of irrigation in connection with a study of the duty of water in the Poudre Valley. This involves measuring all the water that enters the valley and that which passes out of it and also the uses to which the water is put. The problem involves engineering, legal and economic factors, meteorological and soil temperature studies, and advisory work in farm drainage.

The agronomy department is engaged in several lines of investigation. In a study of the relation of the size of oat grain to the amount and times of irrigation the highest yields were obtained when the water was applied just before the time of heading. Some of the strains obtained in breeding oats, wheat, and barley give promise of much improvement in yield over the parent varieties. Cultural and breeding experiments with alfalfa have been made. A very superior strain of Baltic alfalfa has been produced and some of the seed distributed during the past season. Demonstrations in dry farming are carried on at Cheyenne Wells, and at Fort Lewis trials are being conducted to find varieties suitable for elevations of

7,000 to 9,000 feet. Data on farm management from the study of many farms have been made available for the extension division.

It was found that flooding and draining the soil and the growing of cover crops gave satisfactory results in reclaiming niter soils. Potato investigations have received considerable attention in which the effect of different types of soils on the growth, development, and yield is being studied, also the effect of excessive nitrate on the growth and susceptibility to disease and the transmission of characters by seed potatoes that are diseased or badly shaped. Some work is also being done on growing fruit and vegetables at high altitudes.

The veterinary department has been making a survey to determine the prevalence of contagious abortion in range and dairy cattle throughout the State, serum tests being used for diagnosis. Blood and agglutination tests are being compared in range cattle. Attempts are being made to secure a bacterin or virus for immunization against necrotic stomatitis in hogs. A disease of sheep from which a large number had died in one flock, said to be due to heavy feeding of peas, was found to be hemorrhagic septicemia. Experiments were tried of overfeeding with peas, corn chop, and barley, but the results were unsatisfactory. A disease of poultry occurring only in dry lands, attributed to the presence of cactus spines, which is characterized by blisters on the feet and head often resulting in blindness and starvation is being investigated. Attempts have been unsuccessful in transmitting the disease by inoculation, transfusion, or other means from the organisms found in the blisters.

The botanical department is making a survey of Colorado forage grasses and also of the fungus diseases occurring in the State and of the native vegetation as an indicator of crop possibilities. The work of the department also includes studies of proso smut, the microscopy of plants and of flinty and yellow-berry wheat kernels.

Most of the stock feeding in the State is carried on in the neighborhood of beet-sugar mills where beet pulp is available, and information is desirable as to what substitutes for this can be used where it is not obtainable. For this purpose silage and molasses have given very satisfactory results. Pastures are being prepared for grazing to determine the acre value for dairy cows.

Two projects are being studied by the forestry section, one on the decay of wood due to various fungi and one on the control of the dandelion. A study on the utilization of raspberry and plum juices is in progress by the home-economics section. A new department has been added to the station, that of engineering, which is to take up a study of the methods and cost of handling and feeding hay.

Horse breeding for the purpose of securing an American breed of light, active farm horses which can also be used for carriage pur-

poses has been in successful operation for some years. The station now has 79 head of horses in this experiment. Uniformity is now being secured in the colts and a constant type of horses weighing about 1,300 pounds is being produced. The culls from the breeding herd sold last year at an average price of \$112 each.

The following publications were received from this station during the year: Bulletins 217, A Study of Colorado Wheat, II; 218, A Bacterial Stem Blight of Field and Garden Peas; 219, A Study of Colorado Wheat, III; 220, Potato Growing in Colorado; 221, Hot-beds and Cold Frames; 222, The Forcing of Strawberries; 223, A Fruit Survey of Mesa County; 224, Native Vegetation and Climate of Colorado in Their Relation to Agriculture; 225, A Comparative Bacteriological Study of the Water Supply of the City and County of Denver, Colorado; 226, Beans in Colorado and Their Diseases; 227, Dry Farming in Colorado; 228, Divisors; and the Annual Reports for 1915 and 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15,000.00
United States appropriation, Adams Act-----	15,000.00
State appropriation, including balance from previous year-----	44,666.32
Sales, including balance from previous year-----	1,133.07
Miscellaneous, including balance from previous year---	8,061.59
Total-----	83,860.98

The Colorado station is in a flourishing condition, and the outlook for the future with the regular income that is provided for by the millage tax is most promising and indicates the confidence in which its work is held. The work in progress is well planned to meet the agricultural problems of the State.

CONNECTICUT.

The Connecticut Agricultural Experiment Station, *New Haven.*

E. H. JENKINS, Ph. D., *Director.*

The director of the station took a prominent part in the war work for increased production under the State authorities. The regulatory work is steadily increasing, the last legislature having passed acts for the elimination of mosquito-breeding places and the control of the white-pine blister rust and placed these under the director of the station to carry out. As in most stations at this time, some changes occurred in the staff among the assistants. A central heating plant was provided for by an appropriation of \$28,000.

Adams fund projects.—Experiments to determine the relative efficiency of various protein concentrates as the sole source of protein

in the diet, or as substitutes to corn gluten, have been completed. The results show that the commonly used high-protein feeds are quite unlike in nutritive value, contrary to the current assumption.

Raw cottonseed kernels fed to rats as an exclusive diet caused death almost as quickly as if they were starved. This is apparently due to the poisonous principle, as when the kernels were extracted with ether or steamed for a sufficient length of time normal growth resulted, showing that the toxicity could be overcome by suitable methods of heating in preparing the meal. The material was found to contain an abundance of water-soluble vitamin.

An investigation on the value of the soy bean as food showed that it contains suitable proteins and sufficient water-soluble vitamin to promote normal growth and at least enough of the fat-soluble vitamin for long-continued growth and maintenance. In this respect it is unlike the majority of seeds, except perhaps peanuts. The ash constituents of the soy bean were inadequate for promoting growth, but the addition of suitable salts remedied this. The common kidney bean was incapable of promoting more than a very slight growth. Attention has been given to the study of yeast as a source of water-soluble vitamin. With diets containing from 0.5 to 2 per cent of yeast as the source of this essential factor, with suitable pure proteins, carbohydrates, fats, and inorganic salts, rats grew normally to full size. The ash constituents are supplied by a mixture prepared in the laboratory from which any constituent may be taken out and the effect studied. The results showed that calcium and phosphorus were essential elements of growth, but magnesium, sodium, and chlorin were apparently not. Iron proved to be essential, but the animals would live a long time without potassium, responding quickly to this latter element, however, when they had been grown without it. There is some replacing power of sodium and potassium. One function of the inorganic salts in the animal body is evidently the maintenance of neutrality. In the course of this experimental work a number of the animals developed urinary phosphatic calculi. This has been correlated with a deficiency of the fat-soluble vitamin in the diet.

Chicks have been successfully raised to maturity on artificially prepared pure mixtures of nutrients with the addition of some material to supply bulk, blotting paper serving for this purpose. The investigation has yielded some interesting results in the search for vitamins in animal tissues. In this connection the proteids of various ripe seeds and their relative efficiency in nutrition have been studied. Methods were devised for removing the starch with the least possible loss of proteins.

Crossing ordinary varieties of strains of corn picked up in the State resulted in 88 per cent of the crosses yielding more than the average

of the parents and 66 per cent yielded more than either parent. Inbreeding studies have been in progress to determine whether reduction in vigor finally ceases after a certain number of generations and whether such strains always retain their ability to give high-yielding plants when crossed. Crossing inbred strains among themselves gives a remarkable improvement in quality of ear and in production in the first generation. Studies on the cause of hybrid improvement due to both parents contributing the favorable characters which are dominant showed that it can not be secured in a sex-fixed strain because the qualities are linked with factors which are unfavorable and can not be entirely eliminated by selection.

From experiments on xenia in corn considerable increase in protein has been secured by selection from inbred strains, averaging from 15 to 16 per cent of protein but with a low yield, and attempts will be made to improve this quality.

Tobacco breeding is in progress with a view of improving the size, shape, and number of the leaves. Broad-leaf Sumatra is being used for this, the object being to fix the desirable qualities and get uniformity in the crosses.

Work with Hatch and other funds.—Four years' work on corn variety tests in cooperation with the Storrs station have resulted in finding the most productive varieties suited to the northern and southern sections of the State. There was a difference of about 10 bushels between the dents and flints in favor of the former in the New Haven tests, but at Storrs this difference did not hold.

The entomological department has been largely engaged in control and regulatory work under special State appropriations. The life history, habits, and control of the imported pine sawfly have been worked out. A tropical cockroach which was giving much trouble in greenhouses was found to be best controlled by the free use of kerosene. The false red bug, a serious pest of apples, was controlled by the use of Black Leaf 40 in connection with the regular orchard sprays.

A large amount of work is being done on the control of the pine leaf blister rust in cooperation with the Forest Service, United States Department of Agriculture. A survey has been made of the State. Six square miles of the worst infected area were thoroughly cleared of all wild currants and gooseberries. Inoculations were made from the pine to species of *Ribes*, which were successful with 15 species of the latter. Infection was also carried from one species of *Ribes* to another. There was a difference in the susceptibility of different species. Studies are being made of the spread of the disease in the tree, sources of infection, and the way in which it is carried over.

Studies on the root rot of tobacco were carried on in cooperation with the United States Department of Agriculture, including the

effect of the weather, fertilizers, and special soil treatment. Rotation with corn and potatoes appears to be the best preventive. Peach-yellow experiments were continued. The effect of cutting away the roots to note if the disease may be induced by root injury is being tried.

Work in agronomy consisted of variety tests of tomatoes, soy beans, and potatoes, fertilizer experiments with grasses, the handling of apple and peach orchards, selection experiments with rye and alfalfa, and attempts to develop a rust-proof asparagus.

The following publications were received from this station during the year: Bulletins 192, Observations on Alfalfa; 193, Tests of Soy Beans, 1916 (Note on the Plant Food in a Corn Crop); Bulletin of Information 7, "Universal Military Service" for Farmers; and the Annual Reports for 1915, part 6, and 1916, parts 1-3.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$7,500. 00
United States appropriation, Adams Act.....	7,500. 00
State appropriation.....	24,000. 00
Individuals	7,711. 00
Fees, including balance from previous year.....	12,913. 84
Miscellaneous	1,297. 81
Total.....	60,922. 65

The station performs a large amount of regulatory work for the State, but this is so organized that it does not interfere with the research and experimental work. It is carrying on valuable investigations along several lines.

Storrs Agricultural Experiment Station, Storrs.

E. H. JENKINS, Ph. D., *Director*.

There was practically no change in the affairs of the station during the year, no important changes occurring in the staff and no new buildings being added. An increase in the annual appropriation of \$7,500 was made.

Adams fund projects.—Studies have been actively pursued on contagious abortion. The agglutination and complement fixation tests have proved reliable with very few exceptions. Occasionally an animal not heavily infected does not give a pronounced result. Either one may be used as a means of detecting infection, but the agglutination test is the simplest to make and the most practical. Very few mature animals will change their reaction. After they have passed their first breeding period, the chances of infection seem small. All calves at birth give the same reaction as their mothers. In the course of a few months all positive reacting calves do not inherit the disease

itself, but carry for a while the same immune bodies and agglutinating substances that are in the mothers' blood. They remain non-reactive indefinitely, but are most apt to become reactive about the time of sexual maturity. At this period readjustment of the organism subjects it to a strain which makes it prone to infection from any source. The use of an infected bull is an important factor in spreading infection.

In a herd containing reacting cows unpasteurized milk was fed to calves until they were a year old. All the heifers became reactors at sexual maturity, whereas in other herds where the calves received no milk after they were six months old the proportion of reactors was much less, indicating that infected milk at the critical time in the calves' development may be a fruitful source of infection. Bull calves follow the same course as heifer calves as regards their reaction before maturity and may become reactors when a year old and continue so indefinitely. Milk is believed to be a very common source of infection.

Studies on the blackhead of turkeys are in progress. It is believed that the disease is due to an infection and that the only safe protection is to keep the young birds from sources of infection. Observations on white diarrhea showed that after eliminating the reactors in the flock by the agglutination test and inoculating *Bacterium pullorum* into the lower part of the oviduct practically every hen inoculated, and one of the males present gave the agglutination test within a month. If the bacteria reach the ovary the infection becomes permanent and the hens become carriers. There is no evidence as yet that males transmit the disease although they often give the reaction. Young birds which have not reached maturity do not give the agglutination test. It was found that rabbits were killed by feeding them *B. pullorum*, which may have an important bearing on the feeding of eggs containing the organism to young children. It requires complete cooking to kill the organism. Guinea pigs and kittens were not affected.

Breeding experiments on the inheritance of egg-laying capacity have been quite successful. Of 134 pullets 28 laid over 200 eggs during the year. Breeding Rhode Island Reds to develop a nonbrooding strain is also in progress.

Experiments in feeding chickens show that the amount of feed necessary to make 1 pound of gain varies with the stage of growth. A comparison of feeds was made with four lots of hens, a basal ration being fed to one lot as a check. The second lot received peanut meal in the place of sour milk. They ate it readily but did not grow. The substitution of beef scrap for the sour milk in the third lot gave

as good growth as the basal ration, but cost more. The substitution of blood meal proved to be inferior.

Observations on the effect of subnormal temperatures on the growth of the chick embryo during the process of incubation have been carried on for two years and over 6,000 eggs have been studied. There was no particular advantage from cooling alternately, as the hen does, either in the time of incubation or in the vigor of the chicks. Cooling lengthened the incubation period in the spring and was disadvantageous. Sixty-seven per cent of fertile eggs hatched when the eggs were cooled and 70 per cent hatched when not cooled. Embryos of different ages were subjected to a cooling of 50° F. and the effect noted. The day-old embryos withstood this temperature for four hours and hatched. Embryos 12 to 15 days old withstood 15 hours of cooling and hatched. Sixteen hours was about the limit of cooling at any time during the period of incubation that could be borne without injury.

Studies on the poisonous effects of eating rose chafers by chickens have been completed. The life histories of three species of cattle lice have been worked out to determine the period of incubation of the egg and the period of maturity of the lice. Methods of treatment are being tested.

Work with Hatch and other funds.—A large number of variety tests of corn in cooperation with the State station have resulted in a selection of the best varieties for the various sections of the State. Pure-line selection has been carried out with wheat, oats, rye, and barley. Experiments with potatoes indicate the necessity of a moderate application of potash on the lighter soils of the State for this crop. It was not found to be advisable to use home-grown seed continuously. Other field tests included soy beans grown alone and with corn for silage and trials of the various types and strains of soy beans adapted to the State. Studies of varieties of field beans and of strains of alfalfa as to their hardiness were carried on with some encouraging results.

Exhaustive studies have been made of the correlation between the color of various parts of the fowl and its laying capacity, and also the correlation between the total of yearly egg production and the production during certain months of the year. In the former the coloring of the ear lobes, shanks, vent, and beak is noted. In general, a yellow color of these parts indicates a poor layer. The value of this is shown in the fact that in one flock of Leghorns 300 birds were discarded on examination which subsequently laid only one dozen eggs in a week.

The publications received from this station during the year were as follows: Bulletins 87, Fourth Annual International Egg Laying Contest; 88, Bacillary White Diarrhea of Young Chicks—VI, Sec-

and Progress Report on the Elimination of Infected Breeding Stock; and 89, Fifth Annual International Egg Laying Contest.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch act-----	\$7, 500. 00
United States appropriation, Adams act-----	7, 500. 00
State appropriation-----	4, 500. 00
Miscellaneous, including balance from previous year---	8, 572. 28
Total-----	28, 072. 28

The Connecticut Storrs station has several lines of useful and important work, supplementing in an efficient way the activities of the State station.

DELAWARE.

The Delaware College Agricultural Experiment Station, Newark.

H. HAYWARD, M. S. Agr., *Director*.

A commodious and substantial new agricultural building, Wolf Hall, which is a gift to the college, to cost about \$280,000, was nearly completed and will be occupied jointly by the agricultural departments of the college and station.

Several changes occurred in the personnel of the staff, mainly among the assistants, causing only temporary interruption in the work. A new and much-needed department was added to the station—that of plant physiology. E. M. R. Lamkey being appointed to take charge.

In addition to the Federal funds, the station shares in the benefits of a State appropriation of \$10,000 to the agricultural department.

Adams fund projects.—Investigations on inbreeding cattle and hogs are yielding some interesting results. The danger zone is approached when the inbreeding amounts to between 40 and 50 per cent, and when carried beyond 75 per cent with hogs the sows become sterile. Simultaneous matings of an inbred Berkshire sow with an inbred Berkshire boar and a Chester White gave both black and white pigs in the litter, the white predominating, but there were no mixed black and white. The black pigs were vigorous at birth, but after a month failed to gain, and many of them died. Results with cattle have not been so marked. A number of closely bred calves are now in the herd. The only effect thus far is in bringing out some undesirable traits, as a black nose.

A study of the response of different types of wheat to various kinds and quantities of plant food, which has been carried on in the field, is to be supplemented with water cultures. Chemical analysis of the grain and straw shows that some varieties make better use of plant

food or require less than others, some of the poorer varieties taking up more ash than the better ones. One phase of the work, on the tillering of winter wheat, has been completed and published. Studies on the relation of the physical and chemical characters of the corn kernel to the vigor of the plant, in which heavy and light kernels were planted on heavily fertilized plats and on run-out land, have shown some correlations which will be confirmed by water cultures.

A recently started project on the effect of lime on the decomposition of organic matter in soils is being pursued in pots which allow of circulation of air, the amount of carbon dioxid given off being tested periodically and the rate of nitrification being determined. A constant amount of lime calculated to the oxid is used, supplied in different forms as the hydrate, carbonate, ground limestone, slag, rock phosphate, acid phosphate, and gypsum.

A study has been made of the composition of fruit juices, especially relating to the acidity. Determinations of the hydrogen-ion concentration, sugar, and active acid have been made of the peach, pear, and apple in both the green and ripe fruit. The comparatively small variation in the hydrogen-ion concentration in different fruits was noticeable, indicating that the optimum acidity for metabolic purposes is confined to a narrow range. Another striking feature is the constancy throughout the growth of the fruit. Although the total acidity, as indicated by titration, decreases regularly as the fruit approaches maturity; this appears not to be the case with the effective acidity. The effect of acidity in the cultural solutions, as measured by the hydrogen-ion concentration, upon the growth of plants in water cultures is being studied, hydrochloric acid being used in varying strengths. The work thus far has been somewhat preparatory in overcoming certain difficulties, and will be pursued further.

Investigations on the influence of nitrogen, potash, and phosphoric acid on the peach and apple have been in progress for some time. One fact brought out is that the apple responds but slowly to differences in plant food until the starvation point has been reached in one or more of its food requirements. Difficulty in procuring fertilizing material has interfered to some extent with the work. The peach responds more readily to fertilizer treatment. The check plats where no fertilizer was applied yielded 10,420 pounds of fruit per acre, while one plat fertilized with nitrogen and potash yielded 56,349 pounds per acre. Sodium nitrate from the first has shown its effect on tree growth and increased production. In this connection, trees have been grown in concrete pots and analysis of the various crops will be made.

Some interesting results have been obtained in the study of soil bacteriology. A medium has been perfected containing humus which has proved very useful in plating the nitrifying and nitrogen-fixing organisms. Over 2,000,000 of these organisms were found in a gram

of soil in some cases. It was found that lime and manure bring about great changes in the soil flora, the former increasing in many instances the nitrifiers and *Azotobacter*, the latter the ammonifying group, molds, and actinomyces. Phosphates effect little change.

The life history of the slime mold causing sweet potato pox is being worked out, and resistance is being studied with a number of varieties. Sweet potato storage rots in relation to humidity and temperature have been studied in cooperation with the Bureau of Plant Industry, United States Department of Agriculture, with excellent results. By the proper construction of the storage house and control of the ventilation it was demonstrated that loss by rot and shrinkage in storage could be kept as low as 2 per cent.

Work during the year on cucurbit diseases has been along various lines. Considerable variation in susceptibility was found in cantaloups, and resistant strains are being sought for. Anthracnose on watermelon, cantaloup, and cucumber were found to be identical and due to a single form of organism. The organism causing blossom-end rot of the watermelon has been found and isolated. Spraying has not been practiced in the State to any extent, but with losses running as high as 40 to 80 per cent it is to be recommended.

Investigations on peach diseases have been carried on, especially with "yellows" and "little peach," where the pit matures normally but the peaches are small. Inoculations on healthy peach trees from many cases of supposed yellows showed that much that is popularly called yellows are symptoms arising from starvation, peach-borer injury, and other causes, indicating an error in diagnosis. Many of the inoculated trees, however, show symptoms of yellows. It was not possible to confine the infection to the inoculated trees. No successful inoculations have as yet been made with "little peach."

Studies have been begun on changing permeability and its relation to availability. Results thus far show that the temperature, shade, sunshine, and moisture content of the soil affect the permeability and thus complicate results derived from the application of chemical compounds and fertilizers applied to the root system.

Preliminary results of a study of muck as a fertilizer and carrier of beneficial soil bacteria show that it becomes a favorable medium for the growth of such bacteria when properly balanced and reinforced, especially with basic substances.

Work with Hatch and other funds.—Extensive variety tests have been carried on with fruits and berries, new varieties being added as they appear and their value and adaptability noted. Experiments with orchard cover crops show that the cowpea is the best all-round cover crop for Delaware peach orchards.

Preliminary work is being done on a study of the inheritance of head characters in cabbage and the correlation, if any, of other

characters of growth to head character. Similar work has been done in the inheritance of certain peach characters.

Efforts have been made to secure a wilt-resistant cabbage, which have not been very successful as yet. Good results have been reported from the use of resistant tomato seed, which has been developed by selection and distributed in cooperation with the Bureau of Plant Industry, United States Department of Agriculture. In tests of 72 strains partial resistance was noted in some, but the more prolific and heavy early bearers are very susceptible.

The agronomy department is continuing field tests on varieties of grain and forage plants that have been in progress for some years, also fertility and rotation tests, the effect of lime, and of different phosphates.

The following publications were received from this station during the year: Bulletins 112, A Study of Soy-bean Hay; 113, Financial Statement of the Experiment Station Peach Orchard; 114, The Sweet Potato "Soil Rot" or "Pox," a Slime Mold Disease; 115, A Preliminary Report on Muck Humus as a Fertilizer and Carrier of Beneficial Soil Bacteria; and 116, Annual Report, 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$14,000.00
United States appropriation, Adams Act.....	14,025.00
Balance from United States appropriation, Hatch fund..	1,000.00
Balance from United States appropriation, Adams fund..	975.00
State appropriation	10,000.00
Sales	15,380.15
Total	55,380.15

The improved facilities at the station will be of advantage and materially extend its usefulness. Good progress is being made in the problems of special importance in the State.

FLORIDA.

Agricultural Experiment Station of Florida, *Gainesville*.

P. H. ROLFS, M. S., *Director*.

The Florida station in its own particular field is doing work of importance to the State and its sphere of influence is constantly increasing. It is closely allied with the food propaganda, the director being president of the State Food Preparedness Commission.

Recently legislation was enacted whereby a branch station may be established in or near Winter Haven for the study of insect pests, diseases, and other agencies affecting the production of citrus fruits and trees.

The associate chemist, S. S. Walker, resigned during the year. J. E. Turlington was appointed assistant in agronomy. Some other

minor changes occurred in the staff that did not involve changes in the project work. The station receives about \$10,000 from the State, mainly appropriated for repairs and printing. The Florida State Livestock Association donated \$2,500 for the study of forage crops.

Adams fund projects.—The study of soils and fertilizers in relation to the growth and development of citrus trees has been continued for a number of years, both in tanks at the station and in an orchard at Tavares. The tanks in which trees are grown have given valuable data in regard to leaching. The leaching of nitrogen has decreased as the trees increased in size and were able to make use of it. The soil fixes most of the phosphoric acid and the drainage shows no more of it than it did at first. Evidently about all the potash has been fixed that the soil can take up, as it is appearing in the drainage water in increasing amounts for the past two years. The trees growing in the tanks suffered more during severe low temperature than those growing outside. The freeze that occurred during the winter gave an opportunity to note the effect on the fertilized and unfertilized trees in the grove. The injury to the trees was of varying extent. The bloom was nearly all killed and the twigs killed back for a short distance, the defoliation being roughly estimated as 20 per cent. While there was no definite relation established between the fertilizers applied and the effects of the freeze, in general, those plats receiving an excess of fertilizer were more severely injured than those receiving a normal amount. It was further noticed in the grove that the heavily fertilized and limed trees had begun to show "frenching."

Analysis of the soil from the plats which have been fertilized for eight years showed some interesting results. The phosphates are apparently not lost from the soil. Those plats on which four times the normal quantity of phosphorus has been applied gave analytical results showing that the soil was about four times as rich in phosphorus as those to which the normal amount had been applied. The analysis further indicated that the phosphorus remains in the soil in the form of calcium phosphate and that it was not combined with iron or alumina, although there was a sufficient quantity of these in the soil. Three tests for acidity were made over the entire grove during the year. This increases in the summer and goes down in the winter, the explanation of which has not been found. Ammonium sulphate produced much more acidity than any other fertilizer, while floats had no effect.

Investigations on seed-bed diseases, especially damping-off, have been pursued and the control of this by means of chemicals studied. *Rhizoctonia solani* was found to be one of the most common disease-producing fungi occurring in seed beds, but it is not believed that this is the exclusive cause of damping-off. In the greenhouse the application of a one-half per cent solution of copper sulphate at the

rate of 1 pint per square foot proved especially helpful with lettuce, peppers, and celery, but the growth of the latter was somewhat retarded.

Studies of the bacterial blight of cucumbers and the bacterial leaf and fruit spot of peppers have resulted in the isolation but not the identification of an organism which may be an undescribed species. Some interesting results have been obtained from a study of the buckeye rot of the tomato, which does considerable damage in south Florida. The causative agent of this disease was found to be due to a new species and was named *Phytophthora terrestris*. Infection of the tomato fruit occurs only under extremely humid conditions and when the fruit is in contact with the soil, or nearly so. Especial interest attaches to this, as the same organism seems to be an active agent in some of the diseases known under the general name of foot rot in citrus trees. It was repeatedly isolated from many cases of foot rot from different sections of the State and inoculation with pure cultures gave typical lesions as ordinarily observed in the grove. A study of the pineapple wilt shows that root knot is the usual means of entrance of the organism by inducing decay. Several have been isolated, but the specific one has not been identified.

Gummosis of citrus has received careful and extended study. No connection has been found between its appearance and the type or moisture condition of the soil, or of the variety of citrus, although it was found to be most prevalent on grapefruit and sweet oranges. It has not been possible to isolate any single organism from affected trees which appeared to be the causal agent, but *Phomopsis citri* has occurred so frequently in these cultures that it is suspected of having some connection with the disease. It has not been possible to produce the typical disease by inoculation with this organism. For its control the best results follow cutting out all the affected parts, followed by antiseptic treatment, carbolineum giving the best results.

Melanose, which is caused by *P. citri*, can be largely controlled by pruning out all the dead wood in which the disease grows. Work on citrus canker has been mainly on a study of soil cultures. Although these soil cultures were dry, no moisture having been added for 17 months, the organism was still alive in them and the disease could be produced by inoculation at any time. The number and growth of these organisms can be increased in the soil by adding moisture. This shows the long period during which the organism may remain in the soil without losing its virulence.

The organism causing die-back of pecans has been identified as *Botryosphaeria berengeriana* and it has been reproduced by inoculation. The spores in sterile water sprayed on the trees gave negative results, except in some few cases in the greenhouse, but all inoculations into healthy twigs produced infection. Thorough pruning of all

dead branches and affected wood will do much toward reducing the severity of the disease.

Studies in plant nutrition and diseases due to nutritional disturbances have been extensively carried on by the department of plant physiology. Among the diseases studied was frenching or chlorosis of citrus trees. There was found to be a direct relationship in the amount of injury to the amount of limestone contained in the soil. The injury was less in plants grown in sandy-loam soils. There was no marked difference between the plants fertilized with organic sources of nitrogen and those receiving it from mineral sources. Plants receiving fertilizer but no limestone showed some frenching or lack of green color between the veins of the leaves, but no complete chlorosing of the leaves that characterized the plants receiving lime. Those plants receiving neither fertilizer nor limestone showed no chlorosis. These results have been borne out both in field and pot experiments in the greenhouse where citrus seedlings were grown in sandy and sandy-loam soils containing from none up to 95 per cent of ground limestone and receiving various amounts of fertilizer from different sources. In an affected grove where the trouble was thought to be due to heavy applications of ground limestone the extreme conditions are being corrected by using nitrogen from different sources. The disease is probably not the same as the "mottle leaf" of California.

In pot experiments on the fertilization of citrus the inorganic sources of nitrogen have not been found as good as the organic sources for producing vegetative growth. Die-back is apparently connected with excessive amounts of organic matter in the soil, which induces excessive growth. The soils of Florida are usually deficient in organic matter, but the limit to which this may be safely applied is not as yet determined. On the possibility that die-back was produced by the direct action of the organic matter due to poisonous chemical or enzymic action, plants were grown in various materials, as dried blood, uric acid, and sugar. The growth was slower than in the soil, but no disease was produced. It appears to occur only in cases of rapid growth.

Growers have found that bluestone applied to the soil controls the disease, which has been confirmed by the station, about 2 pounds per tree being sufficient. Phosphoric acid in different amounts and from different sources with sulphate of potash has been applied for three years on an old grove of seedling trees. As yet there is no noticeable difference in vigor or production. Similar experiments were carried out on a grove of budded trees of grapefruit and oranges of different varieties. The freeze brought out a difference, especially in the grapefruit which had started to grow before the freeze occurred. Those

trees which had received the highest rate of potash escaped injury, while those receiving less amounts were affected.

The entomological department has continued studies on the velvet-bean caterpillar. This insect appears first in the southern part of the State about the middle of May and migrates northward. It is not as destructive in the northern and western sections as it is in the central portion of the State. The caterpillar will attack the peanut if adjacent to infected fields, but this does not appear to be a favorite host plant. Dusting with a mixture of arsenate of lead and air-slaked lime has proved an effective method of control. A California lady-beetle parasitic on the white fly has been imported and bred in the State. The colony is small, but if it survives the winter it will be a promising addition. Root knot is one of the most serious troubles with which truck growers have to contend. The results obtained by applying cyanamid as a vermicide give indications of a practical method of controlling the nematode. The amount necessary varies with the soil. On some light soils half a ton to the acre is sufficient, while on others as much as 3 tons may be required. The mechanical distribution of this material in the soil seems to be an important factor in securing satisfactory results.

Work with Hatch and other funds.—Studies on the cost of milk production have been made, comparing cottonseed meal, peanut meal, and velvet-bean meal. The results showed that the feed cost per gallon of milk was 16.7 cents for cottonseed meal, 16.5 cents for velvet-bean meal and 15.5 cents for peanut meal. In a comparison of corn silage with sweet-potato silage for milk production, with the former milk was produced at a feed cost of 11.95 cents per gallon; with the latter, 14.11 cents. The sweet-potato silage kept well and was eaten, readily but was rather expensive. Fertilizer tests with Japanese cane indicated that stable manure is the best. It is necessary to replant every three or four years. Tests on withholding the different fertilizer elements from sweet potatoes showed in each case a reduction of about 20 per cent from the average yield of the plats receiving a complete fertilizer. Potash appears to be the element most liable to be deficient in the station soils for sweet-potato culture. In experiments with lime and various forms of phosphate on velvet beans, those plats receiving no fertilizer gave about as good yields as the fertilized plats. Selections of velvet beans, soy beans, and cowpeas are being made for yield of seed, hay, and resistance to root rust.

The following publications were received from this station during the year: Bulletins 130, Control of the Velvet-bean Caterpillar; 131, Pig Feeding; 132, Loss of Fertilizers by Leaching; 133, Irish Potatoes in Florida; 134, Florida Truck and Garden Insects; 135, The Utilization of Cull Citrus Fruits in Florida; 136, Control of

Root Knot by Calcium Cyanamid and Other Means; and the Annual Reports for 1915 and 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15,000.00
United States appropriation, Adams Act-----	15,000.00
State appropriation, including balance from previous year-----	10,542.12
Sales, including balance from previous year-----	3,620.68
Miscellaneous, balance from previous year-----	879.10
Total-----	45,041.90

The spirit of the Florida station is excellent, and its organization and work effectively planned and conducted. It has avoided the mistake of starting more experiments than it could reasonably support and concentrates its efforts on a few important projects.

GEORGIA.

Georgia Agricultural Experiment Station, *Experiment.*

J. D. PRICE, *Director.*

Early in the year a change in the directorship occurred, R. J. H. De Loach, commissioner of agriculture and ex officio president of the station board, resigning and being succeeded by J. D. Price. (See report for 1916.) C. A. Wells, the chemist, resigned, and assistant chemist F. H. Smith was appointed head of the department. B. B. Higgins, botanist and plant pathologist, left for military service.

The chemical laboratory building was enlarged by the addition of two rooms.

Adams fund projects.—In a study of the influence of a combination of feeds on the digestibility of the components, cottonseed meal being added to silage in different amounts, did not affect the digestive coefficients of either, except in so far as the larger silage ration required more chewing. Velvet-bean meal in combination with corn silage is to be studied in a similar manner, and data will be secured as to the time required for food residue passage through the animal. Analyses of the velvet beans to be used in this test showed that there is little food value in the hulls. The potash content of the shelled beans was from 2 to 4 per cent.

The organism causing plum wilt was identified as a new species of *Lasiodiplodia*, which infests the wood, causing gum formation, resulting in sudden wilting due to the lack of water supply from obstruction in the conducting tissues of the wood. It apparently enters largely through wounds caused by the peach borer, and these

should be cleaned, sterilized with corrosive sublimate, and covered with grafting wax. A study of the *Colletotrichum* leaf spot of turnips was completed. The method of tomato-wilt infection and the development of the disease in the plant have been studied in the greenhouse. It was found that the fungus enters through the root tips, passing through the water ducts into the stem of the plant. Search is being made for a wilt-resistant variety. Wild tomatoes from Central and South America are being studied for this purpose. A study has been made of a disease of pecan catkins and methods for its control.

The phase of the investigation of the toxicity of cottonseed meal studied is the relation of the excess of nitrogen to injury. One pig received a basal ration only; two received an addition of cottonseed meal, and two of linseed meal. The one on the basal ration alone gained in weight constantly. Both of the other lots lost weight and died after about two months. The results of the experiment are as yet inconclusive and it will be continued.

Experiments were carried on to determine the effect of feeding cottonseed oil on the butter fat. The oil was fed in different amounts in connection with a basal ration up to 3 pounds a day, which amount soon had to be discontinued. The butter fat was separated and studied. Apparently the percentage of fat in the milk was decreased by feeding the oil, although the yield of milk was slightly increased. No change was produced in the butter fat as indicated by the iodine number and the Halpin test.

Studies on grape breeding showed that certain male vines were decidedly prepotent in giving certain qualities to their progeny. A large number of hybrids are coming into bearing and will offer material for future study. Microscopical studies of microspore development are being carried on in relation to cell sterility. The generate nuclei of sterile vines were found to degenerate soon after the pollen forms. Pecan sterility was found to be due to the fact that in certain varieties the pollen does not shed until after most of the stigma of the pistillate flowers had passed the receptive stage. Mixed planting of varieties is suggested as a remedy. There were indications that the hickory may fertilize the pecan and that parthenogenesis may occur.

The nodule-forming organisms of about 20 species of legumes have been studied in regard to their adaptability to different hosts. Most of these were not found to be transferable. A strain of *Bacillus radicicola* originally isolated from vetch but at that time not having the power to inoculate alfalfa after being in the soil for two years with alfalfa meal, now has the power to produce nodules on this plant, while the same cultures grown continuously on agar had not acquired

the power. Many of the legumes seem to have no bacteria adapted to them.

The effects of stable manure on the soil flora has been a subject of investigation for several years. The increase of bacteria is due to the addition of food material, as sterilized manure caused a similar increase, as did green manures. For a few weeks the number of gas-forming bacteria increases rapidly and they then disappear. There was but little increase in the number of actinomyces. The nature of the soil largely controls the amount of ammonia formed, so that its presence is a test of soil properties rather than of the bacterial flora.

Investigations on the water requirements of cotton agree with the results of previous years and of other experimenters in that the requirement increases with the percentage of soil saturation. Some interesting data have been collected on the regularity of the blooming of cotton. The average period between blooms vertically is 3.2 days, but the regularity is interfered with by outward conditions, as shade, which retards the opening of the blossoms.

Work with Hatch and other funds.—Arrangements have been perfected for collecting the drainage water from fertilized plats to study the loss of fertility, especially in winter, with and without cover crops.

Variety and selection work has been carried on with corn, cotton, bur clover, small grains, legumes, and grasses. Of the cotton varieties, Cleveland gave the best yield, Marlboro proving to be the best variety of corn. Fertilizers put around the corn gave an increased yield of 13.4 per cent over that put under the corn at planting time. The results of early and late thinning of cotton varied with the varieties and soils. Velvet beans planted with corn greatly decreased the yield of corn, especially in rainy seasons, but the total nutrients, including beans and corn, were greater than the corn alone would have produced. One acre, which should have produced 20 to 25 bushels of corn according to land adjoining it, produced only 9 bushels, with 20 to 30 bushels of beans.

Attempts to secure a strain of tomatoes immune to blossom-end rot resulted in an apparently immune strain by crossing the Red Cherry with the Greater Baltimore for the first four generations, the fifth generation showing some susceptibility to the disease. The presence of Fusarium wilt is causing considerable loss in the State, and crosses of wild tomatoes with commercial varieties are being tried to find a strain resistant to this disease. Two years' spraying experiments with Irish potatoes led to the recommendation that only two sprayings of arsenate of lead and Bordeaux mixture be given early varieties. A cross has been secured between the Georgia collard and the Charleston Wakefield cabbage that is now growing true to type, intermediate

between the parent plants. It makes a better head than the common collard. Preliminary studies of the Chinese wood-oil tree show that in the clusters of flowers the terminals are pistillate and the laterals staminate. The kernels gave an oil content of 60 to 65 per cent.

The following publications were received from this station during the year: Bulletins 120, Studies of *Bacillus radicola*—I, Testing Commercial Cultures; II, Soil as a Medium; 121, Transmission of Resistance and Susceptibility to Blossom-end Rot in Tomatoes; 122, The Changes in Composition of Butter Fat Produced by Feeding Cottonseed Oil; 123, Irish-potato Spraying; 124, The Two Groups of Varieties of the Hicora Pecan and Their Relation to Self-sterility; 125, The Associative Digestibility of Corn Silage and Cottonseed Meal in Steer Rations—II, The Influences Exerted by Corn Silage and Cottonseed Meal on the Digestion Coefficients of Each Other when Fed in Combination, as Determined by Means of a Fractional Separation of the Feces; Circulars 69 (revised edition), Station Publications; 74, Report on Corn and Cotton Varieties at the Georgia Experiment Station for 1915; 75, Cotton and Corn Varieties; 76, Report on Varieties of Pecan in 1914, 1915, 1916, at the Georgia Experiment Station; and the Annual Report for 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch act-----	\$15,000.00
United States appropriation, Adams act-----	15,000.00
State appropriation, including balance from previous year-----	2,624.01
Sales, including balance from previous year-----	3,445.36
Total-----	36,069.37

The management and conditions surrounding the Georgia station have been subject to criticism at frequent intervals for many years past, as the reports to Congress show, and its connection with the college of agriculture has not been such as called for by the Hatch Act establishing the experiment stations. The establishment of the station independent of the college and under a separate board antedates the time when the United States Department of Agriculture was charged with supervision of the Federal funds. It had been encouraged to believe that the matter would be remedied by the State voluntarily and meantime the effort was made to bring about improvement in the conduct of the station and to effect close relations with the agricultural college, which would result in larger efficiency and usefulness.

The conditions described in the report for 1916, and the selection of a new director in contravention of the agreement made by the station board a few years previous, to appoint in the station only technically trained and qualified persons indicated a lack of progress and led the department to take action.

Following an interpretation of the legal status of the station the governor of the State was notified that the station as established and conducted was not within the provisions of the Hatch and Adams acts and that remedial legislation was necessary. The funds were continued until the legislature had opportunity to enact such legislation, but it adjourned without taking any action whatever. The certification of the station to receive the Federal funds was therefore withheld, beginning with the first quarter of the fiscal year 1917-18. As the State has never contributed to the regular maintenance of the station, which has been dependent upon the Federal funds, the withholding of these funds left the station in a seriously crippled condition, which, with the resignation of most of the members of the staff, made the outlook for the future quite uncertain.

GUAM.

Guam Agricultural Experiment Station.

C. W. EDWARDS, B. S., *Animal Husbandman in Charge.*

The Guam station is continuing its efforts to improve the condition of agriculture on that island, work with live stock and investigations in agronomy and horticulture receiving most attention.

A. C. Hartenbower, who had been in charge of the station for several years, resigned and was succeeded by C. W. Edwards, Mr. Edwards having been transferred from the Bureau of Agriculture, Philippine Islands. L. B. Barber, veterinarian and animal husbandman, resigned in August, 1916. Glen Briggs, formerly connected with the Oklahoma Experiment Station, was appointed agronomist of the Guam station on March 22, 1917.

A tract of about 30 acres of land adjoining the station at Piti was leased by the insular government and turned over to the station for its experimental work. More breeding stock was added to the station's equipment, including two Toggenburg goats, Berkshire boars, and poultry.

The work with the stock has consisted of increasing the station herds and flocks and making experimental feeding tests to determine the value of locally available materials. Marked improvement in the native stock is being brought about by the use of improved sires. The station has developed a race of pigs which is the result of crossing the Berkshire on a native race, the progeny proving hardy and vigorous and of larger size than the native stock. Two hybrid strains of poultry have also been produced that are very superior to the native strains. In the feeding experiments it has been found possible to substitute native fruits, etc., for a portion of the grain ration without decreasing the feeding value of the ration. The

pasturing experiments with Para and Paspalum grasses are being continued, and the greater value of these grasses as compared with the native species is quite evident. Considerable trouble is still caused by diseases of stock, the goat herd having been nearly destroyed, but losses among the other animals were somewhat less than in previous years. A number of the Morgan horses were transferred to the naval government during the past year. The sires will be available for public service.

In the agronomy division especial attention is paid to grasses and other forage plants, as the amount of forage obtained from native sources is entirely inadequate. The introduced grasses, as Para and Paspalum, continue to be most valuable as soiling crops and as permanent pastures, although it has been found that Paspalum will not stand heavy grazing during the period while it is becoming established. Sudan grass, which has only recently been introduced, is proving to be a valuable soiling crop. Among the leguminous plants, velvet beans, jack beans, cowpeas, pigeon peas, etc., are being investigated as to their value for cover crop and green manure purposes.

The work in corn breeding is being continued with fourth and fifth generation selections, being given thorough trial. Tobacco experiments include fertilizer tests, effect of shading, and means for insect control. Work with cotton is being continued and the possibility of producing cotton in Guam has been demonstrated, some very good yields having been secured.

A beginning has been made of studying the soils of Guam, and through the cooperation of the Bureau of Soils of the United States Department of Agriculture a number of type samples have been analyzed and pot experiments are to be taken up with them at once. Some very abnormal soils have been encountered, low silica and high iron and alumina content being reported.

The work in horticulture has been conducted along the usual lines, but especial emphasis has been placed on seed and plant distribution, vegetable gardening, and fruit growing. More than 50,000 plants, 7,000 packets of seeds, besides other miscellaneous items, were distributed during the year. As with the field crops, it has been found that certain seasons are best adapted to the planting of vegetables. Work along this line, as well as with the adaptability of varieties, is being continued. Experiments with vegetable seeds have shown that they rapidly lose their viability under Guam conditions, nearly all varieties tested failing to grow after being in the island for 8 or 9 months and many giving few plants after 3 to 6 months. A study has been begun of some of the native food plants, especially those which yield starch in appreciable quantity. The station nursery for the propagation of improved varieties of fruits, etc., is being main-

tained, with more than 2,000 trees and shrubs being grown at the end of the year.

The annual report for 1915 was received from this station during the year.

The income of the station during the past fiscal year was as follows:

United States appropriation-----	\$15,000.00
Miscellaneous-----	474.54
Total-----	15,474.54

The Guam station is making progress in the improvement of agricultural conditions in the island, more especially through its work in animal husbandry, agronomy, and horticulture. It has the cordial support of the insular government and the full appreciation of the people.

HAWAII.

Hawaii Agricultural Experiment Station.

J. M. WESTGATE, M. S., *Agronomist in Charge.*

The Hawaii station is continuing its efforts to diversify the agriculture of that Territory. Its experiments are all planned with this in view, and a considerable amount of data had been collected that has proved of great value in the emergency campaign for food production and conservation. Hawaii has long been a heavy importer of foods, and with the reduced tonnage due to war conditions the food situation became acute. Without sacrificing any of the important experimental work the staff entered actively upon a program for the dissemination of information through all available channels.

Several changes were made in the personnel of the station during the year. C. W. Carpenter was transferred from the Bureau of Plant Industry, United States Department of Agriculture, and placed in charge of the division of plant pathology. Kim Ak Ching, a graduate of Kansas Agricultural College, was appointed assistant chemist, and James H. Cowan was appointed assistant horticulturist. Miss Alice R. Thompson, for a number of years assistant chemist, resigned to pursue graduate work at Columbia University, New York. J. B. Thompson, superintendent of the branch station at Glenwood, resigned and was succeeded by R. A. Goff. J. W. Love was transferred from the States Relations Service to the newly established position of executive assistant.

The extension division, organized under F. G. Krauss, with headquarters on the island of Maui, is giving attention to many of the urgent needs of the Territory. Through this division and through the collaborators appointed on the various islands, all people are

being reached, and it is believed that much good is being accomplished. Demonstrations are conducted in many localities to familiarize the people with facts brought out by the station's investigations. In a demonstration experiment conducted on Maui a yield of 100 bushels of shelled corn per acre was secured.

One of the outstanding results of the chemist's investigations was the discovery that pineapple yellows, due to a high manganese content in the soil, can be prevented by thorough spraying of the plants with a solution of iron sulphate. The treatment should be repeated three or four times during the season. As a result of this discovery, at least 5,000 acres of land formerly abandoned for the cultivation of pineapples has been restored to this crop. As a result of experiments in food conservation, very satisfactory methods have been worked out for making flour from such local products as taro, bananas, edible canna, sweet potatoes, and cassava. The extensive studies of the soils of Hawaii that have been in progress for several years have been temporarily abandoned.

The division of horticulture is continuing to give attention to the improvement of tropical fruits for Hawaii. Pineapple-breeding experiments have been begun and the station has a considerable number of seedling plants under test for quality, yield, etc. Avocado and mango breeding work and tests of methods of propagation are being given consideration, and a number of mango hybrids have been produced. Breeding experiments with tomatoes have been begun, and hybrids between native and some cultivated varieties have been made in an effort to develop, if possible, resistance to the melon fly.

The plant pathologist has conducted some very successful experiments for the control of potato diseases, and the value of the treatments has been very widely recognized. Through the station attention has been called to some blight-resistant varieties of potatoes, and these are now being extensively planted. A new disease of potatoes due to mites has been described. Two apparently unreported diseases of Chinese bananas were observed during the year.

The agronomy work continues along about the same lines as formerly reported, rice, taro, various grain crops, leguminous plants for forage and green manuring, and tropical root crops being investigated. The cooperative work with the War Department in the production of forage at Schofield Barracks has been definitely inaugurated, and a large number of varieties have been planted on the tract set aside for that purpose. With rice and taro, the effect of fertilizers and aeration of the soil is being given attention. The superiority of a variety of corn from Guam for planting at low elevations has been established.

At the close of the fiscal year the cooperative marketing division was taken over by the Territorial government. This division was established in 1913 to offer a market for small lots of produce consigned to it by farmers throughout the islands. The receipts increased from \$26,500 in 1914 to more than \$121,000 in 1917, amply justifying the experiment in cooperative marketing and providing an outlet for considerable produce that otherwise would never have reached the consumer.

The following publications were received from this station during the year: Bulletins 41, Phosphate Fertilizers for Hawaiian Soils, and Their Availability; 42, Composition of Hawaiian Soil Particles; 43, Chemical Studies of the Efficiency of Legumes as Green Manures in Hawaii; Press Bulletin 51, The Spraying of Yellow Pineapple Plants on Manganese Soils with Iron Sulphate Solutions; and the Annual Report for 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation-----	\$40,000.00
Territorial appropriation, including balance from previous year-----	3,623.29
Individuals, including balance from previous year-----	966.45
Sales, balance from previous year-----	985.71
Total-----	45,575.45

The plans and efforts of the Hawaii station continued to center on the diversification of the agriculture of the island, with a special view to producing and conserving more food and feeding stuffs, not only to make greater provision for home consumption but also to save tonnage in importation so necessary under present conditions.

IDAHO.

Agricultural Experiment Station of the University of Idaho, Moscow.

J. S. JONES, M. S. A., *Director*.

The resignation of the president of the State university and a change in the commissioner of education occurred during the year. The work of the station, however, progressed without serious interruption. As far as possible, war emergency work was undertaken. Some changes were made in the station staff. W. A. Gardner, plant physiologist, resigned, and new appointments were made in the departments of entomology and plant pathology. Several minor changes occurred among the assistants, causing more or less interference with the work.

There was available for the central station, in addition to the Federal funds, \$8,628.12 and for the four substations about \$8,000. In addition to this the legislature appropriated \$13,000 for a horse

barn and hog and sheep sheds, \$12,000 for a new dairy building, and \$4,500 for a greenhouse. Provision was also made for the establishment of a high-altitude station.

A stove and two stone silos were built at the station, and at the Sandpoint substation a farmhouse and barn were completed.

Adams fund projects.—Apple-breeding studies are now in a condition to yield definite results, as the various crosses that have been made in this project have borne fruit for the first time. The characters that will be studied will include color of skin, shape of fruit, size, flavor, and color of flesh. During the progress of this investigation, while the trees were coming into bearing, data were obtained as to the correlation of date on which growth started, diameter of trunk, terminal growth, date of full bloom, susceptibility to disease, hardness of tree, and the date of setting of terminal buds. All undesirable trees will be eliminated and special attention will be given to resistance to mildew, which is a serious disease in nursery trees.

A study of the factors involved in the ripening of fruit has been along the line of the biochemistry of apple maturing, ripening, and storage. The data secured show clearly the relation between changes in starch, sugar, and acidity, and the physical properties such as osmotic pressure, refractive index, and electroconductivity. Studies will be made on the enzymes and tannic acid and on respiration.

Investigations on the duty of water have been carried on at three localities differing in elevation and climate, field peas grown in potometers being the crop used. It was found that less than one-half as much water was required for the crop at Moscow as at the two other localities, although more than the average amount of moisture prevailed in the atmosphere at Moscow, while at the other stations—at Gooding and Idaho Falls—the season was unusually dry. The amount of water lost by evaporation and that utilized by the plant were determined. Oats are to be used as the crop to study for the year.

A study of the so-called “slick” soils showed that they differ from normal soils in their physical properties only—as to pore space and specific gravity—but with little difference in their chemical composition. The bacteriological activity of Idaho soils has been studied mainly on cut-over lands and timber soils and the effect of sawdust and bark of various trees on nitrification and ammonification. Sawdust in small amounts from whatever source invariably depressed these processes unless 1 per cent of calcium carbonate was present, which indicates the necessity of the application of lime to timber soils. Sawdust from conifers produced a depression of bacterial activity in all cases, that of the hardwoods less so. Maple sawdust showed a stimulation of this activity, which is attributed to the

sugar content. It is not believed that the depressing effect of conifer sawdust is due to the terpenes, but this will be further investigated.

The study of the factors which influence the protein content of the wheat kernel is this year devoted to the effect of rotation. Results point strongly to the probability of a direct connection existing between the soil content of available nitrogen and the amount of protein in the kernel.

The name "apple rosette" appears to be applied to a number of distinct diseases, all of which have some symptoms in common. In some cases direct injury from insects, bacteria, or fungi seems to be responsible, but it is believed to be more commonly due to physiological causes which appear to be identified with certain climatic conditions. During dry summers and falls the terminal buds develop better than the laterals. In the spring these open first, giving a rosette appearance, the laterals opening some days later and the tree then assumes a normal appearance. Those trees which have a large number of water sprouts suffer most.

Attempts to find the alternate host plant of the wheat stripe rust, *Puccinia glumarum*, have not been very successful, but one grass, a wild *Hordeum*, has been found on which the fungus appears to winter. A plague of grasshoppers and winterkilling were unfavorable for the development of this rust.

Work with Hatch and other funds.—A comparison of summer and winter pruning of apple trees showed that summer pruning produced the greatest yield, intensified the color, and in some cases hastened the bearing of young trees and increased the average terminal growth, although checking the total wood growth slightly. Commercial onion culture has received attention. This is becoming an important industry in the irrigated portions of the State. Culture experiments have been carried out with cabbage, garden beans, and other vegetables, including time of planting, varieties, and methods adapted to irrigated regions. Evaporating and sun-drying of fruits and the utilization of fruit by-products are being studied. Small fruits are being tested as to yield, hardiness, growth, and varieties.

The department of bacteriology has been devoted mainly to emergency work in the preparation and distribution of bacterial cultures for inoculation for leguminous plants, mainly clovers and peas, in order to encourage a large acreage. The cultures are sold at cost price and have produced very satisfactory results when used.

Studies on fertilization have yielded some interesting results. Potassium and phosphorus have had no effect in increasing the yield of wheat, while the increase with nitrate of soda was from 5 to 10 bushels per acre. On other farms the increase has been from 40 to 70 per cent. The yield of potatoes was increased 25 bushels per acre, the

second year, with nitrate of soda. Large gains were made with oats following wheat and in wheat following potatoes. Some studies have been made on the cut-over lands of northern Idaho which show that liming has no marked effect on the yield of grain on these soils.

Of several varieties of corn tested for silage purposes, Minnesota No. 13 proved to be the best. Work with forage crops, both legumes and grasses, as to rates and methods of seeding and the use of various mixtures, is being carried on. Variety tests with small grain were seriously interfered with by winterkilling. Field peas sown with mixtures of various grasses are being tested, both for hay and silage.

The animal husbandry department has tested silage crops in feeding cattle and sheep. Four kinds of silage were used—wheat, peas, and oats, peas and wheat, and vetch and wheat. All the combinations proved equal to corn silage for feeding. While farm stock wintered on dry feed, owing to the severe and long winter, came out in the spring thin, with harsh hides, and lacking in vigor, the university animals came out in the best of vigor and finest of bloom. Cattle relished the peas and oats and peas and wheat silages best. Straight wheat silage threw the animals off feed. The breeding flock of sheep was maintained on peas and oat silage as the sole succulent, the result being uniform success in lambing and no loss of ewes. The ewes ate from 2 to 5 pounds a day, with hay in addition, grain being added a short time before lambing. Experimental work with sheep herds and their management has offered opportunity to compare the herds as to size, growth, weight of fleece, and the relation of quantity of milk of dam to finish of lamb. Hogging-off field peas with barley as a supplement was profitable.

The occurrence of manganese in feeding stuffs has been studied. Its presence was proved in wheat, oats, barley, field peas, cottonseed meal, alfalfa, potatoes, apples, carrots, beets, and turnips. In the beet the leaves contained the highest percentage, the roots least. Its physiological effect on animals is to be determined with the possibility of establishing some connection between the mineral content of feeding stuffs and certain physiological derangements.

In a study of the acids of silage other than corn, it was found that in normal silage from forage crops the end products of fermentation were practically identical with those occurring in corn silage.

A comparison of protein from animal and vegetable sources in feeding hens for egg production, using meat scrap, peas, and oil meal, showed the largest egg production where the narrowest animal protein ration was used.

Work on the control of potato diseases, especially *Rhizoctonia*, indicated that the use of clean seed and clean ground gave crops free

from disease. Careful selection of seed and treatment with formalin are recommended.

A forest nursery is maintained for the study of the value of different species of trees under Idaho conditions for range improvement and for planting on logged-over land.

The following publications were received from this station during the year: Bulletins 88, Dry-farmed and Irrigated Wheat; 89, Lamb and Sheep Feeding Experiments; 90, Creamery Records; 91, Methods of Clearing Logged-off Land; 92, Annual Report, 1916; Circulars 3, Feeding for Egg Production; and 4, Forest and Shade Trees and Basket Willows Recommended for Planting in Idaho.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15,000. 00
United States appropriation, Adams Act-----	15,000. 00
Sales, including balance from previous year-----	10,287. 67
Total-----	40,287. 67

A more permanent policy and larger support from the State would very greatly aid the station in extending the valuable work it is carrying forward. Even under somewhat adverse conditions it is doing much highly creditable work that is proving of great benefit to the State.

ILLINOIS.

Agricultural Experiment Station of the University of Illinois, Urbana.

EUGENE DAVENPORT, M. Agr., LL. D., *Director*.

There was little change in work and policy during the year, and only minor changes in the staff. Aside from the Federal funds the State appropriations were the same as for the previous year, namely, \$195,500, distributed as follows: Agronomy, \$114,500; animal husbandry, \$31,000; dairy husbandry, \$21,000; and horticulture, \$29,000.

Adams fund projects.—Studies on animal nutrition have been actively continued, including the influence of the character and amount of food consumed in the nutrition of steers and a study of feeds with special reference to the influence of protein on the formation of tissue and bone. Much of the results of this work has been published.

Considerable work has also been done on inheritance in the determination of the independence or coupling in unit characters in the inheritance of mammals, mice being used as subjects. It was found that the unit characters studied were inherited independently, the fluctuation being exactly in accordance with the law of chance.

An interesting piece of work has been about completed on the relation between the number of fetuses and corpora lutea, to determine

the cause for the extermination of certain zygotic classes. The data accumulated indicate that a larger number of atretic follicles occur in the uterus of yellow mice when mated to yellows than in the uterus of normal mice when mated to yellows. These atretic follicles or disintegrated embryos may represent a pure, homozygous class of yellows which has never been found. Skunk breeding experiments give unquestioned evidence that mutants segregate in Mendelian fashion. Other studies in inheritance were made on the transmission of syndactylism in swine, with results showing that the allelomorphic pair for the form character syndactylism *v.* normal hoof is clearly independent from the allelomorphic pair for the color character black *v.* red.

Studies in apple and bud selection involved the selection and propagation of 5,400 buds. The conclusions reached are that as far as growth is concerned there is no difference in value for purposes of propagation between large and small buds and between buds differently situated on either the tree or the shoot. Seedlings from the seeds of large fruits possess greater vigor than do those from small fruits; also large fruits have a distinctly higher average seed production than small fruits. A large amount of work is being accomplished in peach breeding and in hybridizing varieties and species of the genus *Malus*. Observations are being made on the transmission of characters, such as size, type of foliage, flower color and form, color of seed, and shape of pollen with sweet peas.

Work with Hatch and other funds.—The soil-survey work has been extended, the station now having 42 soil and crop-experiment fields located in various parts of the State which serve to demonstrate the value of permanent systems of soil improvement and maintenance in contrast to the older farm practice. These field tests have shown that the maintenance of organic matter and nitrogen is the greatest practical problem of the Illinois farmer, that phosphorus is the one element of plant food that is most universally deficient, and that limestone must be supplied in abundance to many soils before they can be permanently improved. Farm practice should, therefore, include a liberal use of leguminous crops in a good rotation, a liberal application of limestone to soils that are acid or bordering on acidity, and the use of finely ground raw-rock phosphate in amounts larger than are necessary for present needs until the soil is well supplied with the element phosphorus. An important feature of the work in agronomy is the improvement of crops in quality and yield by selection and breeding. Among other things it was found that shallow cultivation of corn is better than deep, and that one of the most important benefits of cultivation results from the eradication of weeds.

A great variety of work has been in progress in animal husbandry, including hogging-down corn, methods and cost of growing draft mares to two-year-olds, and the maintenance of breeding cows, comparing various winter rations composed of different combinations and summer maintenance on various kinds of pastures with and without supplementing with other feeds. Experiments on finishing calves fed on shelled corn, cottonseed meal, and ordinary silage produced yearlings that brought the highest price in the Chicago market. Snapped ear-corn silage did not give as good results, but under some conditions may have a place in beef production. In an investigation on growing lambs for market two lots were used, one fed a mixture of whole grain, whole oats, and linseed meal ground to pea size, the other the same ration with the grain ground fine. The roughage in both rations was alfalfa hay. In total gains for the feeding period whole grain and ground grain proved nearly equal, but it required 15 per cent less grain to produce the total gain where ground grain was used.

Some valuable results were obtained in a study of forage poisoning. A silage was secured which had produced fatal cases of poisoning, and from this an organism was isolated and a serum produced which proved to have marked prophylactic properties in combating the disease.

The investigations in dairy husbandry have been along the lines of economy of production of milk. One factor of this is good keeping quality, depending on the germ content. Studies along the line of the various avenues through which bacteria may enter show that the construction and condition of the barn has little influence on the germ content of the milk. On the other hand, it was found that under commercial conditions probably more than 80 per cent of the bacteria added to milk come directly from the utensils used. The germ content, however, is not so much a measure of the healthfulness of milk as it is of its keeping qualities. A study of the growth of 125 calves on various rations showed the importance of a liberal use of whole or skim milk during the first two or three months of life. A test of milking machines indicated that they saved labor, but generally had a bad effect on the keeping quality of the milk.

Spraying experiments for apple blotch demonstrated the superiority of Bordeaux to lime-sulphur, but if the Bordeaux is applied in sufficient amounts to control blotch it results in badly russetting the fruit. The most important sprayings are those applied three, four, and seven weeks after the fall of the bloom. Results of the test of dust and sprays in which powdered arsenate of lead and finely-divided sulphur were used, indicate in general a rather favorable control of the codling moth and curculio, with an unsatisfactory control of apple scab and blotch.

In floriculture fertilizer experiments have shown that acid phosphate increases the production of carnations on the soil at the station and previous similar results for roses were corroborated for every variety tested, except Hoosier Beauty. Experiments are being conducted on those diseases which are at present resulting in the most serious loss to the grower, more especially carnation "yellows," the fusarium wilt of carnations, snapdragon rust, and aster "yellows."

New or noteworthy diseases which have been met with in the State are a *Phoma* canker of apple, new to the State if not to the United States; the bacterial shot hole of peach and plum caused by *Bacterium pruni*, new to the State; a cytospora blight of plum, peach, and apple, a disease caused by *Colosphaeria princeps*, which results in the death of cherry and plum trees; the blight of sweet corn caused by *Pseudomonas stewarti*, a new bacterial chlorosis of sweet corn; and a leaf blight of the cowpea.

The following publications were received from this station during the year: Bulletins 188, Methods of Fertilizing Sweet Potatoes; 189 (with abstract), Parasitic Rhizoctonias in America; 190, Soil Bacteria and Phosphates; 191, Yields of Different Varieties of Corn in Illinois; 192, Feeding Pure-bred Draft Fillies; 192, Summary of Illinois Soil Investigations; 194, A New Limestone Tester; 195, Yields of Spring Grains in Illinois; 196 (with abstract), The Use of Commercial Fertilizers in Growing Roses; 197 (with abstract), A Study of the Rate and Economy of Gains of Fattening Steers, with Special Reference to the Influence of the Amount and the Character of Feed Consumed; 198, Soy Beans and Cowpeas in Illinois; Circulars 187, A Serious Disease of Cultivated Perennials Caused by *Sclerotium rolfsii*; 188, The Construction of the Dairy House; 189, The Chinch-bug Outbreak of 1910 to 1915; 190, Caring for Cream on the Farm; 191, Care of the Cream Separator; 192, Why Cream Tests Vary; 193, Why Illinois Produced Only Half a Crop; 194, Field Experiments in Spraying Apple Orchards in 1916; 195, Spring Conditions Affecting the Cream Producer; 197, Essentials in Larger Food Production; 198, Home Vegetable Gardening; Soil Reports 13, Kankakee County Soils; 14, Tazewell County Soils; 15, Edgar County Soils; [Publication], Mobilization for Food Production; and the Annual Report for 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation.....	195,500.00
Farm products.....	53,263.30
Balance from previous year.....	17,762.64
Total	296,525.94

The Illinois station is conducting a large amount of scientific and practical work, not only of particular interest to the State but for the advancement of agriculture in general.

INDIANA.

Agricultural Experiment Station of Indiana, *Lafayette*.

ARTHUR GOSS, M. S., A. C., *Director*.

Director Arthur Goss, after many years of active service in connection with the station, retired and was succeeded by C. G. Woodbury, horticulturist in the university and station. A few resignations and appointments took place among the assistants, and a number of men left to enter the military service or were diverted to emergency extension work.

The station income from State appropriations was over \$90,000. A number of farms for experimental purposes are held on long-time leases in different parts of the State.

Adams fund projects.—Studies of the rusts of North America have been largely devoted to the preparation of a taxonomic monograph dealing with the distribution, hosts, technical description, synonymy, life histories, and bibliographies, a part of which has already been published. This phase of the work is nearly completed.

Investigations on the pasteurization of cream for butter making were concluded. Pasteurization at 145° F. for 20 minutes is the most satisfactory process from the standpoint of germ-killing efficiency, which was 99 per cent, and for the quality of the butter. Nothing was gained by applying the heat longer than 20 minutes, and excessive exposure tended to give the butter a "mealy" body. The flash process at 185° showed a slightly lower germ-killing efficiency and gave a distinctly oily flavor to the butter. Pasteurization does not materially affect the chemical composition of the butter. The fat in butter in storage undergoes but very slight changes. A marked cleavage of the protein compounds takes place, and the conclusion was reached that this is the cause of the changes in the quality of storage butter. The protein hydrolysis may be brought about by ferments, microorganisms, and enzymes or by acids, salts, and metals through catalytic action. This protein hydrolysis can be minimized by improving the quality of the cream, proper pasteurization, reduction of acidity, discarding all rusty cans and utensils, and by careful sanitary precautions with all equipment. Exposure to high temperatures in storage or transit should be guarded against. The microorganisms found growing rapidly in high-acid cream consisted of yeast, torulas, molds, and various higher forms of fungi. These include some active protein-

digesting types which may play an important part in the development of objectionable flavors in sour cream.

In experiments to find a substitute for milk for young dairy calves various mixtures were used, some supplying protein from vegetable and some from animal sources. The vegetable protein meal required 2.71 pounds of whole milk in addition to the meal to yield a body gain of 0.75 pound daily, the animal meal requiring only 1.54 pounds of milk to make a daily gain of 0.8 pound.

The horticultural department has been carrying on investigations in orchard management for several years. The trees are now coming into bearing and some valuable results are being obtained in regard to orchard treatment. This includes methods of mulching, clean culture, and cover crops and combinations of these. Meteorological and climatological records have been kept and their correlation to soil changes and tree behavior noted. Soil-temperature studies showed that as this is merely a reflection of the air temperature the extent to which it can be controlled by cultivation is very small. Rain has no marked influence in warming the soil. There appears to be no direct correlation between soil moisture and soil temperature under field conditions. The rôle of soil temperature within the limits of ordinary cultural practices appears to be a negligible factor in tree growth. Mulching studies show that trees in grass or grass mulch have a larger percentage of fibrous roots in their root system than those having a heavy mulch or clean cultivation, and have a larger root system in proportion to the tops. Trees at the age of those now in the orchard are several times heavier in weight grown with clean cultivation or straw mulch than those under grass.

Attempts to attenuate hog-cholera virus by passing it through rabbits have not proved very successful. Rabbits inoculated with hog-cholera blood showed no noticeable symptoms. The carcasses of these rabbits killed 5 to 7 days after inoculation were finely chopped and macerated in normal salt solution for 24 hours and bacteria-free filtrates made through a Berkefeld filter. Susceptible pigs inoculated with this fluid died of hog cholera in an average of 14 days. Attempts to transmit the virus through the bodies of two or more rabbits in succession were unsuccessful. It was found that dried hog-cholera blood exposed to daylight and room temperature for 20 to 25 days possessed no virulence and did not produce immunity. Dried cholera blood (preserved in vacuum tubes) 150 days old exposed to daylight and room temperature for 15 days produced cholera. It was found practicable to produce immunity by inoculating with blood by gradually reducing the period of exposure to daylight and room temperature. Results with mixed infection show that it is unsafe to use the blood of tubercular virus hogs for

hyperimmunization unless it is passed through a No. 1 Berkefeld filter. Attempts to isolate a specific organism have failed.

Work with Hatch and other funds.—Particular attention has been given to the streak blight of tomatoes, which appeared in the station greenhouse in 1915, characterized by black streaks on the stem and petioles, causing the death of the shoots and sometimes of the entire plant. Attempts to isolate an organism have failed, but infection is readily produced by the extracted juice from diseased plants. Its spread may be kept under control by disinfecting the hands and tools when working among the plants. Attempts are being made to secure a strain of tomatoes resistant to *Fusarium* wilt. A new leaf spot of the cucumber, caused by an undescribed species of *Stemphylium*, has been studied and the causal fungus isolated. Preliminary experiments indicate that this disease may be controlled by Bordeaux mixture. A plant-disease survey in cooperation with the United States Department of Agriculture has brought to light several new diseases in the State.

Treatment of the soil in which lettuce, peppers, radishes, and string beans were growing, with carbon dioxid, showed both beneficial and detrimental effects. Increased bacterial activity was produced and an increase in the water-soluble plant food in the soil, but there was an increase in soil acidity and an exclusion of oxygen from the soil. Fertilizer experiments with lettuce showed that nitrogen produced more response than any other element. Pruning experiments which have been carried on for five years have led to the conclusion that the severity of pruning has no material effect on average tree growth. Lightly pruned trees have produced on an average 83 per cent more fruits, 35 per cent more highly colored fruit, and 15 per cent smaller fruit than heavily pruned trees. In a comparison of cover cropping with bare ground in the orchard the trees on the bare ground made the poorest growth. Weeds do not have much value as a cover crop owing to the ununiformity of stand. The cover-crop plats maintained a uniform and higher soil temperature than the checks. Extensive variety tests of bush fruits are made, with accurate data regarding yield, season, market quality, and hardiness.

The animal-husbandry department has been engaged in experiments to work out methods and rations for economical meat production under Indiana conditions with various classes of farm animals, using the most economical combinations of the available roughage and grain supplements. The value of corn silage as a roughage was shown in 10 trials, where more economical gains were made when this was fed than where no silage was used in the ration. These trials showed clearly that silage is an important factor in suc-

cessful and profitable cattle feeding. A comparison of clover and alfalfa hay as a roughage for fattening cattle led to the conclusion that there is little difference in their feeding value. A limited corn ration, compared with full feed, for fattening steers resulted in more economical gains on the limited ration but a more rapid gain and a higher finish on the full ration. Market conditions were such that the highly finished cattle commanded sufficient premium on the market at the time sold to make the full-fed cattle the most profitable lot. Experiments on feeding lambs have led to the following conclusions: Lambs receiving corn silage as the only roughage did not maintain their appetites or make as rapid and economical gains as those fed with dry roughage in addition. More rapid and economical gains were made with alfalfa hay than with clover hay. The open shed of the right type is to be preferred to a barn for shelter for fattening lambs. More rapid and economical gains were made in fattening lambs when the wool was left on than when sheared.

Poultry experiments have been conducted dealing with the cost of raising chicks, the best temperature for incubation, the feeding value of tankage and skim milk for first and second-year birds, and the inheritance of egg production as indicated by external characters.

In soil fertility studies ground limestone gave good returns in practically all cases, yielding profits ranging from \$3.31 to \$18.34 per acre on various types of soils. Manure applied at the rate of 6 tons per acre yielded returns ranging from \$2.49 to \$1.45 per ton. Acid phosphate per dollar invested has been by far the most profitable of all fertilizer treatments either alone, with lime, or with lime and manure. The results with rock phosphate with and without manure have been irregular. The returns have been greatly increased by substituting clover for timothy in rotation with corn and wheat.

The entomological department estimates that the total loss to the State by insect depredations is 10 per cent of the crops. One of the root borers, *Colaspis brunnea*, has shown great activities in the corn-fields in the southern counties. It was found that only those fields on which timothy was grown the year before were infected, adjoining fields on which no timothy was grown being entirely free from it. The life history, habits, and methods of control of the codling moth are being studied. A carload of potatoes from Australia was found to be badly infected with the potato tuber moth, *Phthorimæ operculella*, which has done much damage in California but has never been reported from Indiana. A warning was immediately published. The department is to install a model apiary for experimental and demonstration purposes.

The following publications were received from this station during the year: Bulletins 128 (popular edition), Steer Feeding—X, Winter

Steer Feeding, 1913-14; 179 (popular edition), Sheep Feeding—IV, Fattening Western Lambs, 1913-14; 185 (with popular edition), The False Cabbage Aphis (*Aphis pseudobrassicæ*); 186, Commercial Fertilizers; 187, Acid Phosphate *v.* Raw Rock Phosphate as Fertilizer; 188, Cooling Cream on the Farm; 189, Cream Testing Balances; 190, Commercial Feeding Stuffs; 191 (with popular edition), Cattle Feeding—XII, Winter Steer Feeding, 1915-16; 192 (with popular edition), Sheep Feeding—VI, Fattening Western Lambs, 1915-16; 193, Skim Milk and Milk Substitutes for Calf Feeding; 194, The Indiana Farm Orchard Operating Costs and Methods; 195 (with popular edition), Temperature Experiments in Incubation; 196 (with popular edition), Cost of Raising Leghorn Pullets; 197, Red Sorrel and Its Control (*Rumex acetosella*); 198, Summaries of Soil Fertility Investigations; Circulars 52, Stallion Enrollment—V, The Stallion Enrollment Law and the Farmer; 54, Community Organization for Promoting the Production of Swine; 55, The Creamery and Testers' License Law—Report of the Work for the Year Ending March 31, 1916; 56, Meeting of Committee Appointed to Recommend Best Methods of Vaccination Control and Eradication of Hog Cholera; 57, Commercial Onion Growing; 58, Stallion Enrollment—VI, Report of Stallion Enrollment Work for the Year 1916, with Lists of Stallions and Jacks Enrolled; 59, The Tomato as a Farm Crop for the Canning Factory; 60, Tuberculosis; 61, Bees for the Farmer; and the Annual Report for 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15, 000. 00
United States appropriation, Adams Act-----	15, 000. 00
State appropriation-----	91, 000. 00
Individuals-----	9, 390. 88
Fees, including balance from previous year-----	104, 260. 13
Miscellaneous, including balance from previous year--	173, 945. 31
Total-----	408, 596. 32

Much work of the highest value has been accomplished, and with increased financial assistance, as the work being done warrants, the station may confidently be expected to produce an increased output of valuable information.

IOWA.

Iowa Agricultural Experiment Station, Ames.

C. F. CURTISS, M. S. A., D. Sc., *Director*.

The work of the year was characterized by satisfactory progress in all of the active projects of the station, special emphasis being placed upon the more practical problems that had special application to the emergency demands of the Nation.

The head of the dairy husbandry section, H. H. Kildee, resigned and was succeeded by L. S. Gillette. G. M. Turpin, poultry husbandman, was succeeded on his resignation by H. A. Bittenbender. A few minor changes also occurred in the staff.

Besides the Federal funds, the station had the benefit of State appropriations to the amount of \$105,880. The purchase of a farm for the use of the animal-husbandry division, with suitable buildings for experimental work, was authorized, to cost about \$75,000. This will give opportunity for many new and important projects to be developed. The sum of \$10,000 was appropriated for the purchase of a well-established and valuable orchard, which will be used by the pomology section for important fruit-breeding projects. A \$20,000 dairy barn is being erected, which will be equipped with the latest devices for handling dairy cattle, young stock, and feeds. An animal-husbandry building is practically completed at a cost, with equipment, of about \$60,000. This includes an abattoir and facilities for the handling and curing of meats and for the study of the feeding problems.

Other buildings added to the station include a cottage for the men in charge of the station herds and flocks, a cottage for the horticultural foreman, a feeding shed and an experimental cornerrib for the animal-husbandry section, a laying house for hens, and a honey house. Fifty thousand dollars was available for the State soil survey, which is well under way. The station has about 25 test fields in different parts of the State, which are cooperatively managed and serve as demonstration farms.

Adams fund projects.—Investigations which have been in progress for some time on the Mendelian unit characters in cattle breeding confirm the fact that the black and red pigment of cattle is an independent allelomorphic pair of characters, and also the allelomorphic nature of the horned and polled condition.

Soil studies indicate that the use of leguminous green manures in crop rotation may not be necessary to keep up the nitrogen content of soils. It is found that if sufficient organic matter is present *Azotobacter* has the power of fixing nitrogen. Apple-breeding work has resulted in the production of several very promising varieties, especially a cross between the Hibernian and Delicious, the fruit of which resembles Delicious in form but is somewhat darker red and with much better keeping qualities. Should it prove hardy it will be a valuable addition to the northern section of the State. Another cross between Salome and Jonathan has good keeping qualities, attractive color, and high quality, and promises to take a prominent place in the apple industry.

Much interest is being shown in the orchard-management studies at the Council Bluffs experimental orchard. The practical demon-

stration of the value of good care is having a decided effect on the care given to other orchards through the State.

Work with Hatch and other funds.—A good start has been made in the soil-survey work, and requests for this from various sections of the State are urgent. A description is given of each soil type of the section surveyed from the standpoints of color, depth, drainage, topography, character of subsoil, and agricultural value; also the plant food content and amount of lime required per acre when the soil is acid, with recommendations regarding the soil management. Extensive cooperative farm tests show that Iowa soils are in need of lime and phosphorus. Experiments have indicated the practicability of preparing acid phosphate on the farm by composting rock phosphate, flowers of sulphur, and manure, which rapidly makes the phosphate available and at a much lower cost than it can be obtained commercially. "Alkali" spots were found to be due to excess of calcium carbonate and to be reclaimed by thorough drainage and liberal applications of manure. American-grown alfalfa seed proved much better than the imported. Of the seedlings reported to the station 85 per cent were successful, with an average yield of 3.25 tons per acre. The failures were due mainly to improper inoculation and lack of lime. In order to obtain good results from red clover a small grain nurse crop should be sown with it, for which purpose the Iowa 105 oat is recommended, drilled in.

The station strongly emphasizes the value of the soy bean, either for seed, hay, or silage. Yields of 30 bushels per acre have repeatedly been secured on good average soils. The beans can be used to advantage as concentrates for live stock, for human consumption, or in various manufacturing processes. Yields of over 2 tons per acre of cured hay are easily secured. Methods of seeding and a comparison of different dates of seeding by different methods have been tried with winter wheat, and it has been definitely shown that the best results are obtained when it is drilled in. A beardless hardy wheat has been developed which promises to be of exceptional value.

The station has advocated the introduction of the self-feeding and the free-choice systems in swine feeding, which have been widely adopted. It has been shown that the same system will work with calves. When allowed free access to different grains and roughages they showed striking ability along the lines of efficient balancing of their rations, although not quite so much so as swine.

Two years' records have shown that in fattening 2-year-old cattle with silage and a grain ration, the latter can be cut down to a quarter or a half of what is usually fed and yield more profit. Thus it was found to be more profitable to feed from 3 to 5 pounds of grain daily rather than from 15 to 20 pounds. This means that nearly twice as

much meat can be produced per acre, which is of far-reaching importance during the present crisis. Chemical analysis of forage crops during their growth showed the variation in composition. Young, tender blue grass contains 35 to 40 per cent of protein in the dry matter. When it becomes dry and hard this drops to 8 or 10 per cent. Pigs do better on the young, tender growth, not only on account of its high protein content but also from the higher percentage of calcium and phosphorus.

Poultry-feeding experiments indicate that growing stock can not be depended on to select the best ration in hopper feeding to produce the most profitable growth. The addition of lactic acid to rations for finishing poultry for the market has failed to show any value. A study of nesting conditions showed that the nest should be secluded, that those containing as many as four eggs were more attractive than empty ones, and that plaster of Paris or wooden nest eggs were apparently more attractive than glass ones.

Comparisons have been made of the profits to the producer from cheese and butter factories. Results show that the former industry could be extended to advantage, the State producing at present only about 15 per cent of the cheese consumed. A study of the high acid organisms of milk, with a view to eliminating or favoring their action, is being made. While these organisms play an important rôle in the ripening of certain types of hard cheese, they are deleterious from the standpoint of the buttermaker. As pasteurization of milk and cream will soon be compulsory in all creameries, ice-cream factories, and market milk plants in the State, the cost of this has been determined and found to be comparatively low. Certain yeasts were found in cream, causing foaming, which results in some loss as well as deterioration of quality. It was found that titration of milk with a standard silver nitrate solution gave a satisfactory index of the chlorin content, but the results were 0.25 per cent higher than those obtained by determining the chlorin in the milk ash.

From a can of evaporated milk that had developed a fishy odor an organism was isolated capable of producing fishiness in milk, cream, or evaporated milk. This is apparently a new species closely related to the *Proteus* group, and has been named *Bacillus ichthyosmius*. The clarification of milk was not found to improve the keeping quality. It increased the bacterial count and slightly reduced the creaming ability. In ice-cream making the freezer was found to be an important source of bacterial contamination. There is an apparent increase in the number of bacteria during the freezing process, which decreases during proper storage. Other lines of work of the dairy department include the influence of the time of freshening on milk production, the water requirements of dairy cows on succulent feeds, the effect of drugs on the cost of raising dairy calves, the

size of calves at different ages, the cost of feeding dairy heifers to time of freshening, and the digestibility of Sudan grass.

An extensive farm-management survey has been made. It was found that the labor income of farmers in the region surveyed increases directly with the size of the farm, until a group of farms 406 acres or more in size is reached, when the labor income decreases. The records show that those who stocked their pastures most heavily were making larger labor-income returns than those farmers who stocked their pastures lightest. The highest priced land in the area surveyed was the cheapest from the standpoint of profit.

During 1916, 50 per cent of the 2 and 3 year old apple trees in many nurseries in the State were destroyed by the crown gall, which is being studied to find a practical method for its control. The blister canker is one of the most destructive apple diseases in the drier portions of the State. Successful tests were made for its control by cutting out all diseased parts and painting with white lead and corrosive sublimate. Ten years ago an orchard was established to study the stock best suited for profitable apple growing where top-working is practiced, which is being quite generally adopted in the State. These trees are now coming into bearing, and valuable information is being obtained. It is found, for example, that Grimes Golden on its own roots is short lived, whereas top-worked on a hardy root it produces larger crops of better-sized fruit.

For the control of apple scab dusting did not prove as effective as spraying and was more expensive. Early blight of potatoes does not normally appear in the State until the latter part of summer and is almost always preceded by tip-burn injury. Bordeaux mixture has proved effective for the control of the blight. The applications should be made at frequent intervals during the last half of the summer rather than at wider intervals throughout the summer. Five applications proved to be most profitable. Tip burn is due to excessive transpiration and is wholly physiological in character. It is not controlled by Bordeaux mixture under Iowa conditions, as it has not given the marked physiological response as a stimulant that it has in other sections, perhaps due to drier atmospheric conditions.

It has been found that the European barberry is the most important agency in the spread of black-stem rust of small grains, which has caused great losses in some districts in recent years, and it is strongly urged that no further plantings of the shrub be made.

In the study of the environmental influences on nectar secretion it was found that the optimum condition for sugar secretion is an alternation of low and high temperatures, and in general the more favorable all conditions are for growth, and the more vigorous the plant the greater is the amount of sugar secreted. Nectar was

found to be most abundant early in the blooming season, other things being equal, and accumulation and secretion of sugar were most pronounced near the time of the opening of the flower.

An important feature of the work of the chemical section was a study of the relative influence of microorganisms and plant enzymes in corn silage fermentation. This has a practical bearing on the storage of silage. The study of the phenomena of fermentation under normal conditions showed that bacteria are mainly responsible for acid production and the concomitant disappearance of sugars. Alcohol is formed first by plant enzymes and later by yeasts. Protein is hydrolyzed first by enzymes and later by microorganisms. Carbon-dioxid production seems to be largely due to respiratory or enzymic activities, but yeasts probably have a share in its production after the first day or two. Microorganisms are probably largely responsible for the heating of silage. Both factors are always present during silage fermentation, and the progress is due to the activities of both in the absence of air. It was found that a considerable amount of mannite was formed in the process of fermentation, especially with certain kinds of plants, and the commercial utilization of such a source of this material has been studied.

The work of the botanical department covered a wide range of topics, including the transpiration of apples, fertilization of fruits, relation of pollination to size of apples, sweet-clover pollination, treatment of hard seeds of sweet-clover, germination and composition of weed seeds, and the development of the seed coat of alfalfa and sweet clover.

Experiments conducted by the forestry section indicate that white pine will not make satisfactory growth under the dense shade of hardwood trees. Although this is classed as a rather tolerant tree when young, results thus far show conclusively that although the tree is not actually killed its growth is so small as to be practically of no account.

The publications received from this station during the year were as follows: Bulletins 151 (abridged edition), Soil Acidity and the Liming of Iowa Soils; 155 (with popular edition), Potato Insects; 164, Studies on the Market Milk of Iowa; 166 (with abridged edition), Community Hog Houses; 167, Rotation and Manure Experiments on the Wisconsin Drift Soil Area; 168, Silage and Silage Fermentations; 170, Evergreen Trees for Iowa; Research Bulletins 26, The Determination of Sulphur as Barium Sulphate; 27, Studies on the Formation of Gas in Milk; 28, Studies on the Clarification of Milk; 29, Studies on the Numbers of Bacteria in Milk Showing Various Changes; 30, Inheritance of Color and Horns in Blue Gray Cattle; 31, Studies on the Creaming Ability of Milk; 32, Estimation of Calcium in Ash of Forage Plants and Animal Carcasses; 33,

Studies on a *Fusarium* Disease of Corn and Sorghum (Preliminary); 34, Studies in Sulfocication; 35, Effect of Some Manganese Salts on Ammonification and Nitrification; 36, Influence of Humus-forming Materials of Different Nitrogen-carbon Ratios on Bacterial Activities; Circulars 16 (second edition), Care, Feed, and Management of the Dairy Herd; 30, Iowa Educational Market Milk Contest; 31, Condimental Stock Foods and Proprietary Remedies; 32, Testing Milk and Cream; 33, The White-marked Tussock Moth; 35, The Barberry Bush and Black Stem Rust of Small Grains; Soil Report 1, Soil Survey of Iowa—I, Bremer County Soils; and the Annual Reports for 1915 and 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15,000.00
United States appropriation, Adams Act-----	15,000.00
State appropriation -----	105,880.05
Farm products -----	33,343.30
Balance from previous year-----	16,056.83
Total -----	185,280.18

The activities of the Iowa station cover a wide field most successfully. The results of its work are being put into immediate practical application, and it has the confidence and cooperation of the farming community of the State.

KANSAS.

Kansas Agricultural Experiment Station, *Manhattan*.

W. M. JARDINE, LL. D., *Director*.

This station, with the liberal State support which it receives, has continued the important lines of work upon which it has been engaged, although experiencing the disturbing influence necessitated by the call to service and otherwise of several members of the staff. Practically all of the members of the veterinary department, including F. S. Schoenleber, the head of the department, resigned to enter commercial work. A number of changes were made among the assistants, most of the positions vacated being satisfactorily filled. W. A. Lippincott returned from a year's leave of absence and resumed duties in the poultry department. E. N. Wentworth, of the animal-breeding department, resigned to enter the Army.

The State appropriations for the central and branch stations were over \$80,000, in addition to which \$80,000 was appropriated for the purchase of additional land, and over \$54,000 was realized from sales. The legislature passed a law creating a new board of administration to have control over all the State institutions, composed

of the governor and three members appointed by him. The board appoints a business manager who has authority to manage and control such institutions and to purchase all supplies by and with the advice of the board.

A complete refrigeration and storage plant costing nearly \$5,000 with a capacity of 8 tons of ice a day was installed in the dairy building. New buildings added to the equipment included a machine and hay shed for the agronomy department, a hog house, two large silos, and a heating plant for the animal nutrition barn. A dairy barn to be used for feeding experiments and a horse barn of rock were built.

Adams fund projects.—The study of the physiological effect of alfalfa hay cut at different stages of maturity upon work horses was interrupted before its completion by the loss of the feeding materials by fire. The preliminary results indicated that there is quite a difference in the feeding value. The greatest gain in live weight was made with hay cut in the bud stage, the least with that cut in the seed stage. Later, however, when all of the lots were put on the same feed the gain was less than one-half from the lot that had received hay cut in the bud stage than those that had received hay cut in the more mature stages. The second crop is ordinarily preferred for feeding horses, and an explanation of this is being sought. A ration of alfalfa hay and corn induced abnormal appetites and formed an insufficient ration for animals at hard work, which is believed to be due to the low-fiber content. In connection with this it was found that the more nearly mature the plants were at the time of cutting the less injury there was on the permanence of the stand.

Investigations with cattle on the influence of nutrition on the form of growing animals showed that normal growth was in length rather than in breadth. A full ration produced a wider and better developed body, while a maintenance ration produced a tall, thin animal. The most economical gains were secured with a maintenance ration for two years, followed by a full feeding for market. A corn diet alone for pigs was found to be deficient in ash constituents and protein. The addition of tankage or other protein to the ration immediately stimulated growth. It was found that alfalfa pasture did not supply all of the deficiency in mineral constituents. In dry lots the free-choice system of feeding swine proved valuable, giving faster gains and a more economical use of feeds, but in pasture lots the reverse was true. Pigs on alfalfa pasture will eat that in preference to concentrates, resulting in an unbalanced ration.

Life-history studies have been made of various insects, more especially the Hessian fly, chinch bug egg parasites, and the corn aphid. The data at hand show that 85° F. and 75 per cent humidity are

the optimum conditions for Hessian fly development. The wind is an important factor in the dissemination of the fly. By the use of upright screens adult flies were caught at points ranging up to 2 miles from infected fields, and one fly was taken at a distance of 5 miles. Field studies show that about 30 per cent of chinch-bug eggs are parasitized, the parasites proving to be most efficient when the daily temperature was about 72° F.

A temperature and moisture control apparatus has been used in the study of the effect of modification of the germ plasm through environment on inheritance, grasshoppers being used. Evidence has been obtained indicating a kind of parthenogenesis in grasshoppers. The life history of the chick nematode, *Heterakis papillosa*, is being studied. The eggs of this parasite hatch in moist earth. Chickens become infected by being fed dung earthworms taken from infected poultry yards. The alternate host of the chicken tapeworm has not yet been found.

Investigations have been made on the deficiency of ash and protein in corn and sorghum grain when fed to rats. The deficiency in ash can be readily made up by adding calcium salts to the ration, and tryptophane and lysin were found suitable for supplying the lack of protein. The protein kafirin in Kafir corn was found to be similar to zein and was inadequate for the growth of animals.

Strains of alfalfa have been isolated which are unusually heavy seed bearers, which is of great importance for alfalfa growers in eastern Kansas. Individual strains have also been isolated which are immune to leaf burn, a physiological trouble due to high temperature.

Work with Hatch and other funds.—The effect of various cropping systems on soil fertility is becoming more pronounced. Plats on which corn has been grown continuously yielded 28.15 bushels in 1910 and 23 bushels in 1916, while the plats on which corn was grown in rotation with cowpeas and wheat yielded 29.59 bushels in 1910 and 42.25 bushels in 1916. The use of barnyard manure in fertilizing alfalfa continued to show increase in value, the figures with the hay computed at \$8 per ton indicating that the barnyard manure had a value of \$5.94 per ton. With corn grown in rotation commercial fertilizers have not given increase in yield sufficient to pay for the fertilizer, but when grown continuously it showed marked increase in yield. The same was true of alfalfa. The factor in increasing yields is phosphorus, the use of potassium giving only a very slight increase over the check plats.

Studies on seed-bed preparation for wheat showed that nitrification is correlated with the available moisture during the summer period, that the available moisture is controlled by the cultivation treatments through the prevention of weed growth, and that the

growth of weeds not only wastes the soil moisture but uses up the nitrates developed, preventing a nitrate accumulation for the fall growth of wheat. Under Kansas conditions it was found that a cultivated soil surface was no more effective than a bare surface in checking moisture evaporation, that nitrification may take place at the same rate on uncultivated soils with a bare surface as on cultivated soils, and that cultivation should aim to keep the soil in a receptive condition to absorb rainfall and to prevent weed growth.

A variety of wheat originated by the station, known as Kanred, has shown very high quality milling properties and is quite rust resistant. The average yield for six years was 31.1 bushels as compared with 26.1 bushels for Turkey and 28.9 bushels for Kharkof. A promising strain of oats has been isolated which is much earlier than the Red Texas usually grown and appears to be more productive. A study of a large number of heads of Kafir corn showed that heavy heads had fewer whorls than light heads and thrashed a higher percentage of grain. In a comparison of corn, Kafir and Kansas Orange sorghum for silage, carried on for a number of years, the sorghum led with an average of 18 tons per acre. Soy beans were found to yield from a third to a half more hay per acre than cowpeas and from two to three times as much seed, several varieties producing 25 bushels or more per acre. Local strains of Kentucky blue grass proved to be better than any introduced strains, indicating that it has become adapted to local conditions.

Some measures looking to the control of the corn earworm are being investigated, chiefly the effect of different times of planting. As a result of eight years' tests corn planted about May 1 gave the maximum yield and minimum injury from the worm. Dust sprays applied with the dust gun were quite effective, the injury decreasing with the increase in the number of applications.

Observations on the relation of aphids to apple and pear blight showed that where the aphids were completely controlled the blight was eliminated. Attempts to bring about infection during August failed, showing that trees are not susceptible during the period when no growth occurs. In September, when the trees had begun to put forth new growth, aphids carrying blight bacteria were confined on twigs by cheesecloth sacks. Every case of blight which developed was on the aphid-infested trees. Other entomological subjects under investigation are the life histories of the Kafir ant, billbugs, green bugs, and flea beetles occurring on the principal crops of southern Kansas.

Sixteen species of May beetles have been studied as to their time of flight and food habits, and life-history studies of 6 species are in progress. Two species of the muck beetle, *Ligyris*, have also been studied and the life histories of eight species of wireworms have been

worked out. Valuable data have been secured on the swarming habits, reproductive period, and longevity of the termite. These are held in check to some extent by parasites which are being studied. Alfalfa insects have been collected and studied, also insects attacking shade trees, including the elm-tree borer, cankerworm, and cedar scale. The elm-tree borer was found to be heavily parasitized by a nematode. The earliest emergence of the cankerworm moth noted was January 5, the last one April 21, the maximum occurring from March 17 to 21, inclusive. Two chalcid parasites were found to be a valuable check to the increase of the cedar scale.

One hundred and fifty acres of pasture protected until September 1 supplied feed for 50 cows and their calves for 70 days, and more seed matured than in the unprotected pasture. Several grasses and clovers have been seeded on the native sod to determine the practicability of improving pastures in this way. Burning over pastures in the spring did not injure the grass as far as its immediate effect was concerned. The burned area warms up earlier, causing the grass to start quicker, giving earlier pasturage.

The cause of roup in fowls has been demonstrated to be due to a bacterium of the pasteurella group, and a bacterin prepared from this organism has proved effective. The characteristics of the organism are very similar to that of chicken cholera and results of the study indicate that fowls immune to roup are also immune to the latter disease. Typical eye lesions were produced by inoculation with this organism.

Bacteriological investigations with silage have shown that acid production is the principal fermentation and that all forage contains the proper organisms for this. The odors developed in silage appear to be due largely to the splitting of nitrogen compounds. Other bacteriological studies included the occurrence of colon bacteria in market milk, the marketing of eggs and poultry, an investigation of canned salmon, and studies of the intestinal flora of pigs fed exclusively on a corn diet. On the subject of marketing poultry some difficulty was met with in determining when a fowl is spoiled and what constitutes a spoiled fowl. No definite relation could be established between the bacterial content and the odor of the slaughtered fowl, and the chemical data obtained by the determinations of the amino acids, ammonia, total acids, acidity, and volatile acids did not answer the question.

A study was made of the keeping quality of eggs and dressed poultry shipped by parcel post. A number of fowls were dressed by different methods and shipped to a town about 50 miles distant and returned for bacteriological examination. The results led to the conclusion that it is not feasible to ship poultry by parcel post during the summer in Kansas. Attempts to use preservatives such as

cane sugar, sodium nitrate, and sodium chlorid have not been successful because of the foreign flavors. Little difference was noted in dry or scalded picked, drawn or undrawn fowls as influencing the keeping quality. Soil bacterial studies included the effect of aeration and moisture and of shallow versus deep cultivation on organisms in relation to nitrate accumulation.

A comparison of Sudan grass and alfalfa hay showed that the former compared favorably with the latter in feeding value. Experiments in feeding sheep showed that this industry can be profitably carried on in the State. Comparative tests were made of feeding Kafir corn, sorghum, barley, and whole corn. Kansas-grown barley was found to have about 90 per cent of the efficiency of corn, while Kafir corn proved about equal to corn. Silage was found to be a good addition to sheep rations. It was also demonstrated that the cost of fattening beef cattle could be materially reduced by the use of silage without detriment to the finish of the animals. Ground barley proved as efficient as shelled corn.

In an extensive feeding experiment for the production of yearling beef, using grade Hereford calves, with various combinations of ground barley, shelled corn, oil meal, alfalfa hay, silage, and sweet clover hay, the most profit per steer was obtained from a combination of shelled corn, oil meal, and sweet clover hay, this averaging \$6.09. The poorest showing was made by a lot fed shelled corn, oil meal, and alfalfa hay that had been stacked immediately after cutting without being cured and had turned black, in which there was a loss of \$3.51 per steer. Chemical examination showed that there is a considerable loss of nutrients when alfalfa is stacked in the green stage.

Tests were made of different forms of traps for catching rats and gophers. The iron base and wooden base snap rat traps were found equally effective and more so than the wire rat trap. Corn meal and rolled oats were effective baits. Arsenic has proved a successful poison in a mixture of one part of arsenic, eight parts of corn meal, and eight parts of sugar, mixed dry. A survey was made of the mammals of Riley County, including the feeding habits, breeding periods, number of young, and the parasites. The tapeworm, *Tænia pisiformis*, which is normally a parasite of the dog, with the cottontail rabbit as an intermediate host, was found to develop also in young cats.

Potato investigations have been conducted along the line of variety tests, disease control, and fertilizer tests. In the variety tests Irish Cobbler and Early Rose (northern) gave the best yields. For disease control it was found that dry sprays could be applied more rapidly and cheaply than liquid ones and were as effective in controlling the potato beetle, but that liquid sprays of Bordeaux mixture were more

effective against early blight. Fertilizer tests showed that potash had the greatest influence on increased yields.

A study of soil management showed that the use of alfalfa as a companion crop may encourage the work of the buffalo tree hopper and that a more vigorous wood production results from thorough cultivation than from growing trees in sod or alfalfa, where the alfalfa is allowed to grow within 3.5 feet of the trees. Summer pruning produced more evenly developed and better balanced tops than either winter pruning or no pruning and the trees were less affected by severe winds. Variety tests with small fruits and garden crops to discover those best suited for Kansas conditions are being carried on. Different methods of pruning tomatoes have been tried. The yield was greatest from plants allowed to grow without any pruning or training, but there was a much larger percentage of sunburned tomatoes. Pruning to three stems gave the best results.

Milling experiments with Kafir corn indicated that a coarsely ground meal is better as a blend for wheat flour than when finely ground. A satisfactory product can be obtained by blending 20 to 25 per cent Kafir corn meal with a good, strong wheat flour, although the best proportion depends on individual taste.

Corn, several sorghums, and Sudan grass were included in a study to determine the effects of maturity and methods of harvesting and curing on the nutrients in forage crops. Corn in which pollination was prevented by covering the tassels with silk showed when harvested a higher percentage of protein and a lower percentage of crude fiber than normal corn. With Sudan grass the percentage of protein is closely related to the yield, when the percentage of protein is high the yield being small, and vice versa. The largest amounts of total nutrients are obtained when the grass is cut in full bloom. With the sorghum plant as a whole, the percentage of crude fiber and protein decreases and the nitrogen-free extract increases as the plant matures.

The severe drought experienced in the summer of 1916 resulted in finding some drought-resistant strains of hybrid corn that are very promising, one proving to be nearly as economical as Kafir corn or Dwarf milo maize in water requirements. A study of the physiological effect of drought shows that under severe climatic conditions corn leaves do not increase in dry weight perceptibly after 10 a. m., while milo maize leaves continue to manufacture food through the hottest portion of the day. The percentage of water in the leaves of corn decreases much more rapidly during a dry day than in milo maize leaves.

The publications received from this station during the year were as follows: Bulletins 211, Soil Survey of Jewell County, Kans.; 212, Sudan Grass in Kansas; 213, The Time to Seed Wheat in Kansas; 214, The San José Scale (*Aspidiotus perniciosus*); 215, Methods of

Controlling Grasshoppers; Inspection Bulletin 1, Kansas State Live Stock Registry Board, V; Circulars 56, Cream Production and Grading in Kansas; 57, Growing Draft Colts; 58, The Woodlot; 59, A Preliminary Report on Two New Methods of Preventing Blackleg by Means of an Antblackleg Serum and an Aggressin; 60, Chicken Management on the Farm; Inspection Circulars 3, Analyses of Inspection Samples of Fertilizers, 1915 and 1916; 4, Analysis of Inspection Samples of Fertilizers, Fall 1916; and the Annual Report for 1915.

The income of the station during the past fiscal year was as follows:

United States appropriations, Hatch Act-----	\$15,000.00
United States appropriation, Adams Act-----	15,000.00
State appropriation-----	80,302.61
Fees -----	54,122.66
Total -----	164,425.27

The Kansas station receives substantial support from the State, which enables it to pursue a number of lines of investigation, with results that amply justify the expenditure.

KENTUCKY.

Kentucky Agricultural Experiment Station, Lexington.

A. M. PETER, D. Sc., *Acting Director*.

The death of the director, J. H. Kastle, occurred September 24, 1916, and A. M. Peter was appointed acting director. Dr. Peter's long connection with the station and familiarity with its organization permitted the work to go on with little interruption. J. R. Humphrey was appointed head of the department of markets, and some additions were made to the staff in the seed laboratory. An appropriation of over \$82,000 was received from the State. The station has five soil experimental fields on typical soil areas. These are conducted at the expense of the station on land furnished by the counties.

Additions to the building equipment during the year included a two-story building for the poultry department, 20 by 32 feet, with a basement containing an 1,800 Candee giant hot-water incubator and a brooder house 16 by 60 feet, also 15 double-colony houses.

Adams fund projects.—Studies of the morphology of the nodule organisms of leguminous plants have led to some doubt as to the different organisms being varieties of one species. Many attempts in the transference of the organism from one plant to another have been made. One organism seems to be adapted to all the *Trifoliums*, but those on cowpeas can not be transferred to the clovers. A search is being made for morphological characters which will account for some of the differences in host preference.

Interesting results are being obtained in the study of the translocation of the mineral matter of plants. For this purpose the jack

bean is grown in distilled water in aluminum cups lined with paraffin with a wax coating over the top. This was found to be more satisfactory than growing them in extracted soils, owing to the difficulty in removing the minute particles of soil from the roots. When the plants have reached their maximum growth and begin to die the parts are analyzed. It is found that 46 per cent of the mineral matter originally in the bean remains in the cotyledons when the plant dies, and attempts will be made to find out why this is not utilized and if it is possible to make it available.

Some work has been carried on to find the relation between nutrition and polyneuritis and osteomalacia in chicks. A decalcifying process evidently takes place on a restricted diet and an attempt is to be made to find the calcium balance.

Work has been prosecuted in a study of sulphur in plants and soils and its significance to permanent soil fertility. Five different crops on eight types of soil were supplied with varying amounts of flour of sulphur. This soon produced acidity by oxidation and the soils were limed at the rate of 4 tons to the acre. The results varied with different soils and crops. An excess of sulphur (200 pounds per acre) was injurious. The gains from the use of small amounts were as a rule quite evident but in some types of soil there was a loss in crop average. When the crops were mature they were analyzed for total sulphur, which was increased in every case, sulphates in the plant being increased with increasing application of sulphur, while residual sulphur (organic and other forms not sulphates) remained nearly constant, indicating that the excess of sulphur taken up was stored as sulphates. Soy beans were an exception to this, the residual sulphur increasing somewhat.

Studies on the rôle of barium in plant growth have shown that in cultural solutions the carbonate and nitrate are not toxic, while the sulphate and chlorid are so. Barium can not replace calcium in plant growth, but plants will take it up in small amounts when it is present, traces being found in the leaves. The conclusions reached are that the small amount of barium contained in most soils does not affect the growth of plants. Manganese has a stimulating effect on plant growth, producing with wheat an increase in yield both of grain and straw up to a certain point. Wheat bran contains 0.1 per cent of this element, which is perhaps essential to the growth and development of the seed of this plant.

Interesting results have been obtained on the action of soil bacteria on potassium in insoluble silicates. Several different species of soil bacteria were isolated and grown in a potassium-free medium. Phlogopite of different degrees of fineness was added to these, and after 10 days the soluble potash was determined. Positive results were obtained in many cases, although the increase in soluble potash was small. The fineness of the mineral had some influence on the

action. *Bacterium orbicularis* and *B. formosa* were the two most active species. If a sufficiently active organism can be found the possibility of isolating a bacteria that can be used for inoculation suggests some interesting possibilities. There are evidently three distinct factors that play a part in making the insoluble potash supply available, namely, weathering, the action of acids, and the biological factor.

Clover bloat or tympany of the rumen of cattle was found to be due to bacterial action in the fermenting clover mass, *B. subflavus* and *B. aerogenes* being the principal forms concerned. The amount of gas formed was found to be in direct relation to the amount of sugar in the plant. Red-clover blossoms contained 3.67 per cent of sugar. The third crop of alfalfa is more apt to cause bloating than the first two, explained by the fact that alfalfa flowers contain 2.88 per cent of sugar. Formalin appears to be the best remedy, being easily applied and inexpensive.

Work on contagious abortion in horses and cattle has been actively prosecuted. A bacterin has been prepared which has been quite successful in immunizing. The treatments are given seven days apart for six weeks, the immunity lasting for six or seven months. Infection appears to come through the food, the incubation period being 11 or 12 days. Abortion in cattle is not produced by the same organism that produces it in mares. Methylene blue seems to be the best remedy. Sanitary measures should be adopted at once when the disease appears and the animal should be kept isolated as long as there is any discharge.

Work with Hatch and other funds.—The chemical department has been engaged in experiments on sulphur in compost in relation to sulphofication. Nitrification was found to be very active when some sulphur was present. Other lines of work included the amino-acid content of foods and feeding stuffs, and a study of the amino acids contained in the protein of grasshoppers, June bugs, and other insects with reference to the part they play in the diet of fowls allowed free range.

Immunization for hog cholera with attenuated virus has been quite successful. Eight nonimmune shoats were given 1 cubic centimeter of the virus weekly for six weeks and were then injected with 2 cubic centimeters of fresh virus. All of them proved to be immune.

Experimental work on the residual effect of feeding beef cattle with corn silage in winter, followed by grazing in summer, showed that the feeding of silage was profitable. In a comparison of close confinement with open range, the confined lot made better and cheaper gains and sold for a better price. Feeding sorghum silage and finishing with cottonseed meal has not proved successful, while corn silage with cottonseed meal was profitable. The elimination of

corn for the first three months, then feeding it for 90 days, gave good results.

Considerable experimental work has been done with breeding sheep. Crosses made with mountain ewes and pure-bred rams increased the fleece 3 pounds with the first cross. Sheep scab has been eliminated from the State by work carried on at the station in co-operation with the Bureau of Animal Industry, United States Department of Agriculture.

Feeding velvet-bean meal to hogs has not proved very satisfactory. The results of experiments in hogging down soy beans and cowpeas show that the former is not profitable unless a supplementary feed is given, but is quite so if corn is used. A lot of hogs receiving 2 per cent of their weight in corn meal daily produced 825 pounds of pork per acre, at a cost (including cost of seed, cultivation, rent of land, corn meal fed, and labor) of \$4.54 per hundred pounds of gain. Valuing pork at \$7 per hundredweight the net value of pork produced by an acre of soy beans, after deducting all expenses, was \$20.32. The value of the fertility left in the soil was \$17.68, which, if included in the profit, makes a total of \$38. It was not found profitable to hog down cowpeas, even by supplementing with corn meal.

Poultry experiments showed that free range was more profitable for egg production than confinement. In an egg-laying contest conducted at the station one White Leghorn pullet, Lady Walnut Hill, broke the world's record by producing 94 eggs in 94 consecutive days.

Dairy farm management studies were conducted in four counties.

In addition to its research work the station has charge of the administration of the fertilizer, commercial feeding stuffs, food and drug, food sanitation, nursery inspection, and seed laws of the State.

The following publications were received from this station during the year: Bulletins 201, Hogging Down Soy Beans and Cowpeas; 202, A Preliminary Study of the Marketing of Burley Tobacco in Central Kentucky; 203, Concentrated Commercial Feeding Stuffs; 204, Further Investigations of the Etiology and Control of Infectious Abortion in Mares; Circulars 12, The Egg-laying Contest; 13, A New Sweet Corn Disease in Kentucky; and 14, The Home Garden in Kentucky.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation.....	82,490.92
Fees, including balance from previous year.....	116,132.57
Sales	27,709.79
Miscellaneous, including balance from previous year---	508.98
Total.....	256,842.26

Although there have been disturbing conditions which have rather tended to interfere with the effective work of the station, it has made good progress. It is to be hoped that these conditions will be remedied in order that the station may realize the highest degree of usefulness under its funds.

LOUISIANA.

- No. 1. Sugar Experiment Station, *Audubon Park, New Orleans.*
- No. 2. State Experiment Station, *Baton Rouge.*
- No. 3. North Louisiana Experiment Station, *Calhoun.*
- No. 4. Rice Experiment Station, *Crowley.*

W. R. DODSON, A. B., B. S., *Director, Baton Rouge.*

The work of the Louisiana stations has been largely a continuation of that carried on in previous years. The time of the director has been very fully occupied, not only with the administration of the four stations under his control in the State but also with extension, administration, and some college work.

Changes in the staff caused rather serious temporary interruption in several lines of work. E. W. Kerr, who had been in charge of the projects on sugarhouse engineering for several years, resigned, and it was not possible to fill the position. M. A. Schneller, chemist at the sugar experiment station, and W. L. Owen, bacteriologist, resigned to go into commercial work.

The State appropriations for the fiscal year for the four stations were \$24,000. No important addition to the buildings or equipment was made during the year.

Adams fund projects.—A study of the clarification of cane juice, on the cause of the black or dark coloring matter, showed this to be due in part to the presence of polyphenols, as has been previously reported. The nodes, pressed separately, always gave a darker juice than the internodes, and the polyphenols were found to be most abundant at that point. Another factor is evidently the presence of the borer, which occurs in the internodes. Comparing the juice of the internodes of infected and uninfected cane, the former was always the darker. The yellow coloring matter present occurs in the rind and is apparently of a chlorophyll nature. Where the sugarhouse equipment is largely of iron this is supposed to be a source of coloration. Attempts to clarify such a juice with sodium aluminate and subsequent working in copper evaporators did not produce the desired results, the white sugar produced possessing to a higher degree the property of darkening on storage, which is explained by the formation of alkali decomposition products which, like the natural tannin bodies, form black iron compounds. This demonstrated the necessity of working with a distinct acidity if iron evaporators are used.

Further studies were made on decolorizing material. Norite, an imported commercial product, when applied to the juice removes 80 per cent of the coloring matter, causes no inversion, and has the property of absorbing the objectionable tannin bodies to a much higher degree than does bone black. Its high cost makes it almost prohibitive. It may be regenerated by boiling with alkali. Its use practically allows refined sugar to be made direct from ordinary juice. It is about 20 times as efficient as animal bone black.

The analytical problem of direct sucrose determination in the presence of reducing sugars by destroying the rotary power of the latter by heating with alkali has been quite successfully worked out. This method yielded satisfactory results with artificial mixtures of sucrose and invert sugar. With invert sugar sirups the results were more accurate than with the Clerget inversion method, which shows an apparent sucrose content when secondary condensation products of fructose are really present. The application of this method to sugar-house products has not been entirely satisfactory and the problem will be studied further.

Studies on the bacteriological deterioration of sugar showed that there are three main groups of organisms involved—bacteria, torula, or nonspore-forming yeasts, and molds—mostly of the *Aspergillus* group. It was found that molds will work at a higher sugar density and are the most dangerous, although it is believed that bacteria may become acclimated to high densities. Spores seem capable of germinating at as high a density as the organisms grow in, but the higher the density the slower is the germination. This gives rise to a difficulty in sterilizing sugar. For the growth of yeasts and molds the medium must be acid. The nitrogen requirement is low with all of these forms, but is highest for torula and lowest for the molds. No limit has been found to the density at which torula may cause fermentation of invert sugar, but its action on sucrose is small.

The deterioration is due to the film of molasses surrounding the crystals and not to the sugar itself, and experiments have been made on the keeping quality of laboratory-made sugar with molasses film of known composition. The nutritive value of the film was changed by adding various substances. The addition of 0.1 per cent of peptone gave a considerable increase in inversion, as did the addition of the ordinary dirt collected in a sugarhouse. Attempts have been made to determine the safety limit of film density for bacteria, torula, or molds. It has been found that molds are capable of causing deterioration of films of higher density than bacteria or torula, and that the action of bacteria is limited to very moist sugars—that is, of low density films. Torula only destroys sucrose in rather acid sugars, which also have comparatively low density films. Since there is prac-

tically no limit to the deterioration of invert sugar by torula, the latter may pave the way for the action of molds on sucrose. The rate of deterioration of samples stored at 20° C. was only 5 per cent as rapid as the same samples stored at 34°, the samples in both cases containing over 3 per cent of moisture, which was thus not the limiting factor. These experiments suggest the possible utilization of cold storage for the warehousing of sugar.

Experiments on the relative deteriorative powers of 18 bacterial cultures that had been isolated from sugar and its products showed some cultures to have as much as four times the deteriorative powers of others. Only 2 of the 20 torula cultures showed any sucrose-inverting power, and this was very slight as compared with the bacterial cultures. The most active inverting torula only caused a loss of 15 per cent of sucrose in a 50 per cent sucrose solution during a month's incubation, the bacterial cultures causing a loss of 40 per cent in the same solution in half the time. Mixed inoculation showed no symbiotic relationship between the two. The maximum limit of density for the bacterial cultures was found to be between 60 and 72 Brix, while no limit has yet been found for the activity of the torula in fermenting invert sugar. Above 65 Brix the action of the torula upon sugar solutions containing both sucrose and invert sugar is exclusively confined to the latter, thus explaining the decrease in certain sugars during storage. These experiments emphasize the importance of cleanliness in the manufacture of white sugar. The experiments indicate that the most active infection of sugar comes from the old sources of contamination in the sugarhouse rather than from infection introduced from the outside.

Some studies were made on the fermentation of table cane sirups by torula. This results in increased purity by fermenting the invert sugar but the cans are spoiled by puffing. The torula have an extremely high resistance to heat compared with yeasts. It would require heating to about 90° C. for 15 minutes to sterilize the product which might affect some of the constituents of the sirup.

Experiments were made upon the retention of unwashed sugars of the microorganisms contained in their massecuites, which showed that an average of 13 per cent was retained and that washing reduced the number by approximately one-half.

Selection for resistance to cotton wilt, which has been in progress for some years, has resulted in a few fairly resistant strains in which length of staple has also received attention, 1.25 inches having been secured in one strain. Tomato-wilt studies have been continued on the life history of the organism, varietal resistance, effect of temperature and consistency of soil, and selection for resistance. A method of resistance selection has been worked out which has proved very useful. The seed-bed soil is steam sterilized and then inoculated

with the wilt organism, which grows very rapidly. Young plants grown in this soil succumb before they are ready to transplant if they are susceptible to the disease, those that survive showing more or less resistance.

Studies on the eggplant blight show that it is carried over in the seed and in refuse from the crop in the field. The fungus appears to be quite variable, some strains being more infectious than others. Control measures have not been very successful. Peruvian alfalfa appears to be more resistant to crown rot than other varieties. The red rot of sugar cane, which reduces germination and causes considerable loss, was found to gain admission to the stalk of the growing cane through borer holes, for which no method of control has yet been found.

Studies on the methods of anthrax dissemination have been continued as to the common, bloodsucking insects as carriers of the disease. The hornfly and the mosquito were able to transmit the disease to guinea pigs. It was found possible to do this four hours before the pig died. The organism does not seem to pass through the fly or mosquito, being killed in the process of digestion. Other insects will be studied in this connection.

Investigations on the toxicity of cottonseed meal and its feeding value, as compared with other so-called toxic feeds, have been made upon pigs. Six lots of six pigs each were used, one lot being fed cottonseed kernels, a second cottonseed meal, other lots receiving rice polish, milled rice, tankage, and palm-kernel meal. The experiment was continued for 158 days. Most of the lot receiving cottonseed meal died before the end of the period, those remaining making no growth. Two of the pigs on cottonseed kernels died, and the others gained nothing the last two months. Those on milled rice gained 210 pounds and were healthy, except two, which developed stiffness and soreness of the hind legs, which are symptoms of beriberi. The tankage-fed lot did the best, gaining 555 pounds, those on palm meal making a gain of 268 pounds. Post-mortem examinations showed the tankage pigs to have fatty degeneration of the liver, but otherwise they were in excellent condition. The liver of the palm-meal pigs was fibrous and solid. Those fed on cottonseed meal and kernels showed little or no degeneration of the liver. Those on rice and rice polish had hard, fibrous livers but the flesh was in good condition.

Santonin proved to be the most effective remedy for eliminating internal parasites of pigs, but is expensive.

Work with Hatch and other funds.—Fertilizer experiments on cane still show the advantage of potash. Calcium cyanamid ranked close to sodium nitrate and ammonium sulphate as a source of nitrogen, but it can not be mixed with phosphate without causing reversion. Doubling the amount of phosphoric acid used from 250 to 500 pounds of acid phosphate increased the crop of cane 5 tons.

Four foreign varieties of sugar cane were added to the collection, two known to produce unusually large tonnage, one resistant to the cane borer, and one resistant to disease. Louisiana 511 has proved a very superior seedling and has been distributed. A strain of white flint corn which has been developed has yielded 63 bushels per acre, although injured by heavy winds. Clover sown on Johnson-grass land gave two almost pure cuttings of clover, but the third was nearly pure Johnson grass. In an experiment on eradicating Johnson grass by the kudzu bean, the grass was nearly killed out in four years.

At the Baton Rouge station corn and soy beans proved to be the best silage crop. Japanese cane made a good grazing crop for steers. Although the fall and winter were very cold and wet, 20 steers were practically maintained on this crop for 60 days. A comparison of palm-kernel meal with peanut meal fed in conjunction with soy-bean silage showed the two feeds to be about equal in feeding value, although the palm-kernel meal was more expensive. In hog-feeding experiments 1 bushel of corn produced from 12 to 16 pounds of pork. Two and a half to 3 bushels of sweet potatoes equaled 1 bushel of corn in feeding value. Hogs grazed on soy beans and corn followed by peanuts and corn, then sweet potatoes, and back to corn and soy beans brought the highest price in the market, producing a good, hard pork. Comparing oats and silage for the production of milk results were in favor of grazing oats. Trials of various crops are being made to work out a good rotation for the dairy industry, the principal crops being oats, corn, soy beans, sorghum, Japanese cane, turnips, carrots, stock beets, and Lespedeza hay.

At the North Louisiana station a comparison was made of storing sweet potatoes by banking them in the open and in a properly constructed storage house. By the former method a large percentage was lost, while by the latter 400 bushels stored in the fall kept in perfect condition until July.

At the rice station at Crowley, with fertilizer experiments with rice, on all plats on which available phosphate was used since 1910, five profitable crops of rice were grown, the highest yield being 28 bushels per acre. The last two crops were not profitable owing to the heavy growth of water grasses, especially the water crab grass and foxtail. Profitable yields were obtained the first year only with potash, since then the yield being little more than the checks. There was, however, no water grass in the potash plats. Cottonseed meal or manure appeared to be profitable on Honduras rice.

Crude oil has been successfully used in controlling the rice-root maggot. The use of 15 gallons of this increased the yield 25 to 40 per cent and did not injure the rice unless the leaves rested on the surface of the water. Forty gallons per acre have been used without

injury to the rice. If the land is drained and allowed to become dry 15 days after the initial irrigation, the damage by the maggot is largely prevented. If irrigation is delayed or if the land is drained and allowed to become dry during the growing season, there is little if any danger of "straight head," a disease, the cause of which is not known, that seems to occur on land containing a large amount of organic matter.

Of the various varieties of soy beans tested the Biloxi proved to be the best, giving a heavy yield of thrashed beans on ordinary rice land. Garlic proved to be a good winter crop for rice lands, yielding 2,000 pounds per acre. Brussels sprouts and bell peppers were profitably grown for the northern market and extensive plantings are being made.

The following publications were received from this station during the year: Bulletins 156, The Direct Determination of Sucrose in the Presence of Reducing Sugars; 157, The Coloring Matter of Cane Juices; 158, Tests of the Power and Steam Consumption of Sugar Factories; 159, Experimental Studies of Vacuum Juice Heaters; 160, Tests of Boilers with Bagasse as Fuel; and the Annual Report for 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation	25,500.00
Fees.....	13,266.19
Sales	4,016.97
Miscellaneous	1,447.70
Total.....	74,230.86

The Louisiana stations are actively engaged on problems that will effectively meet the principal agricultural needs of the State. They have developed increasing interest in their work and enjoy a strong, appreciative following.

MAINE.

Maine Agricultural Experiment Station, Orono.

C. D. WOODS, Sc. D., *Director.*

The station underwent some changes in its staff, especially in the department of biology, and during the latter part of the year the director was called to Washington to engage in war emergency work. These changes affected the work to some extent, yet on the whole the year was a successful one.

An annual State appropriation of \$5,000 was made for animal husbandry and a similar amount for the maintenance of the Aroostook farm.

Adams fund projects.—The investigations on cattle breeding have been continued and are nearing completion. Over 2,000 complete service and birth records are on hand, which will furnish a valuable basis for the study of many vitally important problems in the physiology of reproduction. One of the primary objects of the project was to collect statistics bearing on the question as to whether the proportion of males and females in cattle could be influenced or controlled by the time of service relative to the beginning of the period of heat. Some earlier statistics collected by the station appeared to indicate that there was a possibility of influencing the sex ratio by paying attention to this point. From a careful study of the large amount of statistics at hand, it is concluded that there is no definite or permanent relation between these two factors.

Another phase of the problem was the effect of inbreeding in cattle in relation to productive qualities. Preliminary results indicate that in Jersey cattle there is a possible relationship between the degree of inbreeding and productivity, the closer the degree of inbreeding within certain limits, the higher the productivity. An intensive study has been made of existing records of milk and butter fat production in the Jerseys. The effect of every Jersey bull, where records for two or more daughters or sons were available, has been worked out and a comprehensive and scientific measure of the true breeding worth and value of the various blood lines has been obtained. A plan has been worked out whereby it will be possible to give information to breeders as to whether any particular bull is exercising a beneficial or harmful effect in the herd. Breeding experiments are in progress, with a view of studying Mendelian factors, by crossing low-milking and high-milking breeds, using Jerseys, Holsteins, and Aberdeen-Angus. A herd of about 40 head of first-generation hybrid animals is being built up for this study.

Extensive investigations have been carried on with poultry along various lines. Reciprocal crossing of Barred Plymouth Rocks with other breeds of fowls has been continued satisfactorily, and important results in inheritance are being obtained. Studies have been made on the physiological factors and principles involved in egg production. These have included studies in the production of dwarf eggs and of double eggs, where a small but perfect egg is formed inclosed in a larger one. The effect of feeding various chemical substances to chicks, to learn the effects on the growth and upon the development of the reproductive organs, has been carried on with dried glandular material of the ovary, certain organs of the brain, and with certain calcium and phosphorus salts. It was found that by

feeding a very minute amount of certain calcium salts it was possible to cause a marked increase in the rate of growth of pullets, while the cockerels remained unaffected. This work bears upon the fundamental chemical basis of sex.

A study of the effect of age of breeding stock on reproductive ability in poultry has been completed. Experiments on the effect of ether, ethyl and methyl alcohol on the germ cells of poultry have been carried on through the year. The alcoholized birds were apparently somewhat better layers than their normal sisters and the offspring of the parents treated with alcohol or ether were larger and more vigorous. Two pullets whose parents in the one case had been alcohol treated and in the other case ether treated have, respectively, the second and third highest egg record ever produced at the station, namely, 274 and 270 eggs per year. It was found that by evaporating a small amount of alcohol in the incubator daily during the first two weeks of incubation all of the weak embryos that would not develop strong chicks were killed in the eggs, while the chicks which did hatch were stronger and better, grew faster, and had a lower mortality than those from untreated eggs.

In the entomological department work has been continued on the Syrphidæ or flower flies. The *Syrphus* maggots are among the most beneficial insects of the State, feeding upon the aphids. Some species, however, are harmful, attacking bulbs, as the onion, and one group attacks standing timber. Further work has been done upon the life history of the flea beetles. Not only is there confusion in the systematic classification of these insects, but the range of food plants of each species is not known. Many of the plants and trees they attack are of great economic importance. Studies will include their parasites and natural enemies and methods of control. Attention has been especially directed to those attacking the elm and strawberry.

Other studies of important economic insects included the meadow plant bug and leaf hoppers, the parasites of a species of *Lepidoptera* found on the blueberry, the currant-fruit fly, and various species of aphids. It frequently happens that species of the latter insects attack different host plants during the summer than during the winter and spring, which has often led to their being considered as two different species. Thus one of the most troublesome of the plum aphids migrates to water plants during the summer. One of the woolly aphids of the elm migrates to the root of the Juneberry for the summer, and the pink and green potato aphid passes the winter and spring on the rose. One species migrates from the apple to the oat, and one from the chokeberry to the oat. Another of the plum aphids spends the summer on the thistle.

Investigations in plant pathology included a study of the organisms causing blackleg of the potato. This occurs in Europe and Canada as well as in the United States. Comparative studies of the organism causing this disease, from various foreign localities as well as from Maine, show that they are all essentially identical, although it was formerly believed that they were different species. It is therefore probable that the same methods of control as recommended by the station would be universally successful.

Field and laboratory studies of the relation of net-necrosis to spindling sprout of the potato have been carried out, together with its cause, distribution, and control. Attempts have been made to isolate the causal organism and to determine the means of transmission of the mosaic disease of the potato in cooperation with the Bureau of Plant Industry, with no definite results as yet. The disease is much diminished in the plantings at the Highmoor station, but appears again in the Aroostook station. Some work has been done on the treatment with iron sulphate and sulphur and lime spread on the soil when the seed is planted. Studies on the control of Rhizoctonia on the potato have not been very successful, and it is believed that the best results will be obtained by developing resistant strains, which is being tried.

The powdery scab of potatoes is being studied, particularly with reference to soil relations and other conditions which influence its development. It is apparently due to soil and climatic conditions, high moisture and low temperature being favorable to it. A new and obscure type of potato disease has been under observation which appears to be associated with lack of potash.

Work with Hatch and other funds.—Extensive experiments to test the effects of inbreeding poultry have made satisfactory progress. Some deterioration in the quality of the stock is beginning to appear, and the question as to what extent this is due to inbreeding will be studied. Comparative tests have been made of the leading makes of coal-stove brooders as to economy, ease of operation, and quality of chicks. Experiments undertaken on the method of feeding hens by allowing a full choice of feed from among wheat, oats, cracked corn, corn meal, bran, red dog flour, linseed meal, and meat scrap, each in a separate hopper, with no scratch feed in the litter, resulted in a great saving of labor, and the lot thus fed outlayed those fed in the regular way. Continued success has been obtained in breeding for egg production. For example, one Barred Plymouth Rock fowl made an average record during the first four years of her life of 163 eggs per year and is now laying well in her fifth year.

Experiments were carried on at the Aroostook farm to determine the necessity of potash in potato growing. Results show that under certain seasonal and soil conditions the addition of potash materially

increases the yield, but if it can not be obtained a profitable yield can be secured without its use on land that is in good condition. In view of the present shortage of potash, this work is proving of great value to the potato growers of Aroostook. Experiments on the method of applying fertilizers to potatoes indicate that as good or better results are obtained by applying all of the fertilizer in the planter, which is the cheapest and most convenient method. Plant-breeding work is being carried on with potatoes, oats, wheat, and some of the pasture grasses.

Fertilization tests with oats showed that potash was not a limiting factor. A series of fertilizer experiments with a rotation of potatoes, grain, and grass has been begun, which will be continued for a number of years. The optimum amount of fertilizer for potatoes will be determined. Experiments have shown that 1,500 pounds per acre gives more profitable results than the heavier applications used by many growers.

The isolation and propagation of pedigree strains of oats and their hybridization has been successfully carried on and improved seed distributed. Hybridization was used to combine desirable qualities into a single strain and to eliminate the bad characters as far as possible, with very promising results. In addition to the practical results, this work is furnishing a large amount of valuable data on the inheritance of oat characters. A number of superior strains of beans which breed true to seed have been isolated and several new types have been produced by hybridization. The effects of cross and self-pollination on flint corn are being studied, a large number of hand-pollinated ears having been secured. The work of cross-breeding apples for the purpose of studying the laws of inheritance and of producing new types has been continued. Some important evidence has been secured relative to the self-sterility of some varieties. It appears that the Ben Davis is particularly self-sterile. Further studies have been made of the mutual influence of stock and scion.

Orchard spraying experiments show that the various sprays commonly used, including standard dilutions of lime-sulphur, tend to increase russeting of the fruit. The best results, as far as russeting was concerned, were secured when arsenate of lime was used for the insecticide, but the scab control was not as efficient as when arsenate of lead was added to the lime-sulphur.

The following publications were received from the station during the year: Bulletins 250, Studies on Oat Breeding; IV, Pure Line Varieties; 251, Control of Apple Maggot by Poisoned Bait Spray; 252, Spraying Experiments and Apple Diseases in 1915; 253, Syrphidae of Maine; 254, Studies of Life Histories of Froghoppers of Maine; 255, Dwarf Eggs of the Domestic Fowl; 256, Elm Leaf Rosette and Woolly Aphid of the Apple; 257, Abstracts of Papers not Included

in Bulletins, Finances, Meteorology, Index; 258, Some Commonly Neglected Factors Underlying the Stock Breeding Industry; Official Inspections 77, Extracts and Spirits; 78, Clams, Oysters, and Scallops; 79, Commercial Feeding Stuffs, 1915-16; 80, Commercial Fertilizers, 1916; 81, Commercial Agricultural Seeds, 1916; 82, Miscellaneous Drug Preparations; Documents 522, Spraying Potatoes in 1916; 523, The Preparation and Use of Lime-sulphur in Orchard Spraying; 525, Apple Tree Insects of Maine; 526, New Varieties of Oats; 528, Spruce Budworm (*Tortrix fumiferana*); and 531, Potato Growing and Potato Diseases from Maine to California.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation.....	14,105.42
Fees	12,755.14
Sales.....	14,013.75
Total	70,874.31

This station continues its important work for the agriculture of the State. It is laying special stress on fundamental problems underlying practical questions and is thus making important contributions to agricultural science in general as well as to farm practice in the State.

MARYLAND.

Maryland Agricultural Experiment Station, College Park.

H. J. PATTERSON, D. Sc., *Director*.

As in nearly all of the stations of the country, the staff was to some extent broken up by the call to military service of some of its members, but nevertheless the year was a successful one. E. S. Johnston was appointed in charge of the work on stone fruits, succeeding F. S. Holmes, and J. E. Metzger took the place of N. Schmitz as agronomist. F. T. Kocher succeeded S. S. Buckley as animal pathologist until May, when his position was filled by S. E. Isaacson. Several minor changes were made among the assistants.

Some additions were made to the farm buildings and considerable equipment was added to the institution.

In addition to the Federal funds the State appropriated \$25,000 annually for two years, with \$5,000 additional for the Ridgely substation. The station now has the use of \$30,000 for soil investigations which has been in litigation, the courts recently deciding in favor of the station.

Adams fund projects.—A study of tomato blight showed it to be caused by a *Septoria*, the life history of which was worked out. It was found to occur in some other plants, as the potato and horse nettle, but does not do serious injury to these. The investigation has

included the variation on different hosts and the relation of infection to different environmental conditions.

Much material has been gathered for a study of the relation of sulphur and sulphur compounds to cell structure, soy beans, mustard, and tomatoes being used for this purpose.

Some very interesting results have been obtained in studies of the influence of carbon dioxid on metabolism in the potato that have an important bearing on storage conditions. It is shown that in storage organs the carbohydrates, involving the reducing sugars, sucrose, and starch, tend to maintain an equilibrium which is shifted within certain limits by new sets of conditions. Varying ratios of carbon dioxid and oxygen in the surrounding atmosphere will produce such a shifting, which, it was found, could be prevented by the removal by ventilation of the carbon dioxid arising in the tissues by respiration. Spindling sprout appears to be intimately connected with the carbohydrate transformation in the potato tuber.

Investigations on methods of cutting seed potatoes to hasten sprouting and to conserve seed showed that the buds near the cut surface are the first to sprout, apparently due to their greater accessibility to oxygen. Buds in parings one-quarter of an inch thick produced good plants, but from thinner parings the results were not satisfactory.

Investigations with greenhouse mites, especially *Tarsonemus pallidus*, show that it is instrumental in transmitting geranium diseases. Bordeaux mixture was found effective in killing the insect without injury to the geranium foliage. A new peach pest (*Laspeyresia molesta*), apparently introduced from Japan, which enters the green fruit threatens to be of a serious nature and is being studied to determine the best methods for its control. Considerable work has been carried on and much of it completed on the leaf miners. For the control of the columbine miner (*Phytomyza aquilegia*) it is recommended that cultivation be given about the plants before April 1 and the removal and destruction of infested leaves in May. The leaf miner (*Pegomya hyoscyami*) occurring on the spinach and other plants was found to be very generally parasitized by *Opius foveolatus*.

Studies on the food requirements of plants have been carried out with wheat, soy beans, and buckwheat by the "triangular" method of different stages of growth, three periods being made—the first two of 30 days each and the third to maturity. In connection with studies on the environmental factors influencing bacterial changes and activity in the soil, temperature records at different depths both under sod and cultivated surfaces have been made.

An investigation on the food value of various milks for infants and invalids promises results of importance along the line of modification of the coagulation of the curd of cows' milk to make it more readily digestible. The curd of human milk is a feathery mass which is easily

digested, while that of cows' milk is of a leathery consistency. Lime water will lighten the curd, but it throws out the calcium balance of the food. It is found that not only different breeds but different individuals vary greatly in curd quality. Attempts are being made to develop a test that can be quickly and accurately applied to milks to determine their value as an infant or invalid food. Further studies are being made on the physiological and chemical changes taking place in the mammary gland during lactation.

Work with Hatch and other funds.—The selection and purifying of strains of tomatoes resistant to *Fusarium* wilt has been successful and the improved seed has been distributed. That fertilization exerts some influence on variation was shown by experiments in which black-eyed peas were changed to brown by this means. Many variety tests have been carried on with vegetables, especially the tomato. Three hundred seedlings of the McCormick potato are under observation, with promise of some interesting strains. The field work includes fertilizer experiments with asparagus and celery seed selection to obtain strains resistant to leaf spot. A plant-disease survey of the State is being carried on in cooperation with the United States Department of Agriculture. Extensive experiments in grape culture have been made, including variety tests, trellising *v.* training, and crossing. The Clinton seems to have a dominating influence in transmitting its vigor and hardiness to its offspring, even on tender types. The season was favorable for the strawberry crop and many new varieties were tested and methods of growing and fertilizing compared. Many apple and pear hybrids have been produced which are being tried out. The planting of Persian walnuts and pecans is becoming more extensive in the State, several hardy varieties having been found.

Cooperative work with the Bureau of Entomology of the United States Department of Agriculture on the control of house flies by the maggot-trap method has been very successful. Three traps, two of which have been in operation for two years, have captured 6,879,271 maggots, the reduction in flies in the neighborhood being very noticeable. For the control of the woolly aphid spraying the roots and crowns of nursery stock with two applications of an 8 per cent emulsion of pine-tar creosote were sufficient. Tobacco preparations were found to be very efficient in controlling greenhouse millipedes, also nicotine sulphate in the proportion of 1 to 750 or 1,000 parts of water. The fumigation of greenhouses with hydrocyanic acid was found to be most efficient in the absence of light, with as low a temperature as is consistent with cultural practice and with the atmosphere as dry as possible. In comparative insecticide tests spraying resulted in larger crops than dusting, but the latter is less expensive. Cabbage showed an increase of 25 per cent in production for the plants treated three times over those treated once.

In a study of the protection of dairy cattle from flies, a 3 per cent emulsion of pine-tar creosote with caustic soda gave good results, the cost being less than a half cent per cow per application, and the cattle protected from flies gave a larger milk production.

The management of bees kept in hothouses for purposes of pollination is being studied to determine the conditions under which they can survive longer than one year. The bees appear to exhaust themselves or starve in commercial houses and new hives must be secured each year.

An extensive soil investigation which was provided for by the State legislature is now under way in various localities, and will include pot experiments and chemical analyses of the soil, as well as field tests and liming experiments. The latter have shown that on some soils a dolomitic limestone reacted favorably, on others, unfavorably. In one instance only a slight benefit was secured from the use of dolomite, while calcium limestone increased production 300 per cent.

Poultry experiments have included attempts to substitute vegetable concentrates for beef scraps and other meat feeds. It was found that eggs for hatching should not be kept longer than two weeks.

Extensive experiments on tobacco are being carried on in cooperation with the United States Department of Agriculture on land rented for the purpose. The State seed inspection laboratory and also the biological laboratory for the production of hog-cholera serum are in charge of the station.

The following publications were received from this station during the year: Bulletins 193, Tests of the Availability of Different Grades of Ground Limestone; 194, Sudan Grass; 195, Onions; 196, Methods and Problems in Pear and Apple Breeding; 197, Clover and Grass Seed Inspected in 1914; 198, Wheat; 199, Tests of the Value of Stable Manure, Commercial Fertilizer, and Crimson Clover for Vegetable Crops; 200, Winter Oats, Barley, Spelt, and Emmer; 201, Soy Beans; 202, Timothy Fertilization and Culture; 203, Agricultural Seed Inspected in 1915; and the Annual Reports for 1915 and 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000. 00
United States appropriation, Adams act.....	14,472. 49
Balance from United States appropriation, Adams fund	527. 51
State appropriation, including balance from previous year	35,079. 98
Sales, including balance from previous year.....	22,703. 64
Miscellaneous	92. 41
Total	87,876. 03

The Maryland station made good progress during the year in its various lines of work, and is conducting successfully a large amount of well-organized scientific investigation as well as making the results of this work practically applicable to the varied agricultural industries of the State.

MASSACHUSETTS.

Massachusetts Agricultural Experiment Station, *Amherst.*

W. P. BROOKS, Ph. D., *Director.*

The activities of the station have been extended by the establishment of a market-garden field station at Lexington, which was provided for by the legislature, to be used partly for demonstration. Other appropriations included \$35,000 for general maintenance, \$6,000 for feed control, \$9,000 for fertilizer analysis, and \$500 for dairy inspection.

The new microbiology building was completed and occupied, providing commodious and finely equipped laboratories for experimental work. G. E. Stone left the botanical department and was succeeded by A. V. Osmun. A new field pathologist, W. S. Krout, was added to the staff in the botany department. Numerous other changes occurred affecting only minor positions.

Adams fund projects.—A study of the asparagus plant was conducted mainly on the problem of keeping the tips. The sugar was found to disappear rapidly as a result of respiration, accompanied by an increase in the amount of fiber. They should be canned quickly after picking or kept under cooled conditions. Observations on the fertilizing of cranberries confirm the results of last year, that there is no necessity of fertilizing the better bogs. Nitrogenous fertilizers produce a rank growth of vines. When sodium nitrate is applied the berries seem to be inferior in keeping quality.

The botanical department has been doing a large amount of laboratory work to determine the response of stomata to changes in light intensity and to light quality, and a preliminary study was made on the light requirements of garden crops. The response of the plants is measured by anatomical, photosynthesis, leaf area, and other tests. In this connection a study has been made of the physiology of the stomata in connection with fumigation and the action of various gases.

Investigations on the mosaic disease of tobacco have been completed. The disease is highly infectious but not contagious and is not carried by bacteria or fungi. It is believed to be induced by a disturbance of the enzymic activities due to abnormal metabolism. Extensive studies have been made on the so-called "tobacco sickness," caused by the root-rot fungus. Ninety per cent of the tobacco

fields proved to be infected. It occurs in both new and old land and appears to be less prevalent in acid soils, which suggest a method of control by increasing the soil acidity. Treatment of the soil with chemicals has been tried with partial success.

Work on the project of the chemistry of butter fat has been largely preliminary in devising methods for the determination of the different fatty acids, which has been successful. The burning of foliage by insecticides has been studied with pure insecticide material and with commercial preparations. Arsenite of lime has been found so difficult to control with safety that it is not recommended, and arsenate of lead should be substituted for it. Considerable burning resulted from Paris green.

Work on the solubility effect of ammonium sulphate in the soil showed that where this had been applied aluminum sulphate, manganese sulphate, and iron sulphate were to be found.

Insects injurious or beneficial to the cranberry have been studied as to their habits, life histories, and parasites. These have included the fruit worm, blackhead cranberry worm, fireworm, the spittle insect, and a new pest, the cranberry root grub, which is believed to be *Amphicoma vulpina*.

Investigations on the interrelation of stock and scion in apples have been more or less preparatory. Eleven thousand trees on known roots are well established, and some are just beginning to bear. It is expected that valuable data will be obtained when the orchard comes into full bearing. Measurements of the trees have been made and already give indication as to vigor of growth and earliness of bearing.

A study of the presence and disappearance of organic matter in the soil and its influence on fertility has been somewhat interrupted by changes in the staff, but will be taken up again later.

Attempts to develop a strain of nonbroody Rhode Island Red fowls have been carried on through five generations, but about 25 per cent still show broodiness. It is a sexual and an individual quality, and the time between broody spells varies. Data on the broodiness of over 3,000 hens have been collected.

The veterinary department has studied methods of diagnosis of bacillary white diarrhea. In this connection the distinctions and relations of *Bacterium pullorum*, fowl typhoid, and the cholera group have been studied, using rabbits for inoculation in part. An attempt has been made to isolate the toxin of *B. pullorum* with some success. The investigation also includes the production of antibodies with special reference to the potency and rate of production, also a study of the progeny descended from stock known to have definite infection to determine the potency and rate factors of the agglutinins liberated.

European foul brood of bees is apparently transmitted through the ovaries. Putting in a healthy queen checked the disease, but the reason for this is not known.

Work with Hatch and other funds.—An interesting study has been made of the local balance of trade in farm products in selected towns. It was found, for instance, that onions and potatoes are shipped from Amherst to Boston, a distance of 70 miles, and then shipped back again to the retail dealers. The proportion of locally grown food products handled by the local stores was small. A detailed study has been made of the methods and cost of producing and distributing tobacco, showing a lack of system, the crop not being sold on a quality basis, but on a contract made in advance, not binding on the dealer, but depending on how the crop turns out.

Results of soil tests showed, among other things, that lime was the dominant requirement for sweet clover. The continued use of sodium nitrate was found to reduce the necessity of applying potash even to those crops for which this element has been regarded as being the principal requirement in the soil where these experiments have been carried on. Lime was found to be of the greatest importance in the production of cabbage, and acid phosphate alone or in any combination had a marked effect in increasing the crop.

A comparison of the residual effect of applying manure for a series of years during the winter and in the spring showed that the spring application gave a more rapid early start to the crop, earlier maturity, and a larger yield. Dissolved phosphates gave superior results to the natural rock or bone. Experiments undertaken with a view of discovering methods of increasing the availability of the potash of the soil and subsoil showed that neither better aeration of the soil nor the use of lime had any appreciable effect, but the addition of organic matter greatly increased the yield and the amount of potash taken up by the crop of Japanese millet. Applications of dissolved bone-black apparently increased the lime requirement.

The botanical department has determined the optimum temperature for spore germination of the *Antirrhinum* rust, which will have a practical bearing on its control, as sulphur dioxide is toxic to the fungus during this period. Bordeaux mixture proved to be superior to commercial fungicides for spraying celery.

A number of digestion experiments have been carried on with sheep in which various feeds have been tested, including Diamond gluten meal, wheat gluten meal, corn bran, distillers' grains, vinegar grains, garbage tankage, soy-bean hay, sweet clover, Sudan grass, cabbages, carrots, mangels, turnips, and pumpkins. Sudan grass was found to be as digestible as Japanese millet and sweet clover, as much so as red clover and alfalfa. Wheat gluten when fed with hay improved the

digestibility of the fiber and extract of the latter to a slight extent. Carrots also improved the digestibility of hay. The protein in garbage tankage was found to have a low digestibility.

Sweet clover did not produce a second crop even when cut before blooming and six or more inches above the ground. It is doubted if it will prove of much value to the dairy interests of the State. Sudan grass yields one heavy crop and a fair second growth with favorable conditions.

Cranberry culture has received much attention. It is believed that the weeds in the bog may be valuable as an indicator of the treatment required. Storage investigations showed that as the crop is ordinarily handled the fruit is bruised to such an extent as to seriously impair its keeping quality. Spraying the vines for fungus diseases improved the keeping quality of the fruit. Various phases of bog management are under investigation, as drainage, flooding, methods of harvesting, and the control of weeds and fungus diseases.

Investigations by the entomological department show that the second brood of the codling moth is not sufficiently numerous to require spraying. A combination of soap and linseed oil was found to be effective for the control of the red spider in greenhouses. For the control of the European corn borer, which was introduced into the eastern part of the State and threatens to be serious, it is recommended that the stalks be either burned in the fall or winter, buried, fed to stock, or silaged. The life history is being worked out.

Experiments have been conducted on methods of suppressing and controlling European foul brood. Dequeening and requeening both proved satisfactory.

Temperature observations in connection with the killing of buds have established a definite relation between killing temperature and elevation, which will be of value in locating peach orchards. Preliminary experiments have shown that the soy bean may be made an important addition to our food products.

Numerous experiments have been in progress in the poultry department. The quality of a distinct winter cycle in egg laying is thought to be an inherited one. Some interesting results were obtained by unsexing and implanting ovaries in cockerels. The birds produced spurs and grew to full size, but the feathers and comb were those of the female. A large amount of control testing for white diarrhea has been done over the State by the agglutination test. Of over 20,000 birds tested, more than 2,000 reacted. It is believed possible to greatly reduce the ravages of the disease, if not to eradicate it altogether. Hog-cholera investigations have been continued. The length of time immunity inherited from an immune

dam persists is being studied. It is believed possible to develop an immune race of hogs.

A series of pot and field experiments have been conducted with Thomas slag, to determine whether its activity is due to the phosphoric acid or the lime which it contains, the lime being controlled and the phosphoric acid made the limiting factor. The pot experiments showed a higher availability of the phosphoric acid in this material than that in acid phosphate.

The following publications were received from this station during the year: Bulletins 168, Report of Cranberry Substation for 1915; 169, Connecticut Valley Onion Supply and Distribution; 170, Shade Trees—Characteristics, Adaptation, Diseases, and Care; 171, A Chemical Study of the Asparagus Plant; 172, Experiments in Keeping Asparagus After Cutting; Meteorological Bulletins 330-341; Control Series Bulletins 5, Inspection of Commercial Feedstuffs; 6, Inspection of Commercial Fertilizers; Circulars 64, Cooperative Soil Studies by the Agricultural Experiment Station and the Extension Service of the Massachusetts Agricultural College; 65 (revised edition), Campaign to Eliminate Bacillary White Diarrhea; 66, Poultry Farm Disinfection; and the Annual Report for 1915, parts 1 and 2.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation, including balance from previous year	54,859.90
Fees	9,641.81
Sales	10,903.08
Miscellaneous	12,418.39
Total	117,823.18

The work of the station rests on a sound scientific basis and covers a wide range of topics relating to the agricultural and horticultural interests of the State. The increasing State support that is being given is an indication of the appreciation in which it is held.

MICHIGAN.

Experiment Station of Michigan State Agricultural College, *East Lansing*.

R. S. SHAW, B. S. A., *Director*.

A number of changes occurred in the staff, especially among the assistants, due to the prevailing war demands, which crippled the work to some extent during the latter part of the year. The State appropriations for the year were \$22,000, and about \$22,000 was received from fees, sales, and other sources. A new farm of 96

acres, which was to be used by the crop department, was taken over for a military encampment, but will eventually revert to the use of the station.

Adams fund projects.—Studies on the keeping quality of butter showed that while many of the bacteria present grow well on agar containing 16 per cent of salt, the rate of reproduction in pure cultures in milk was greatly reduced when 5 per cent of salt was added. The proteolytic action on casein in presence of 5 per cent salt is weakened partly because of the interference with growth and partly by retarding the activity of the proteolytic enzymes, thus indicating that the presence of as small an amount as 1 per cent of salt in butter not only inhibits the formation of digestive enzymes, but also retards their action.

The effect of contagious abortion on the milk of the cow was studied on seven farms where the disease was prevalent, and it was found that 27 per cent of the animals had udders infected with *Bacillus abortus*. These animals become carriers and a possible source of infection for years, as in no case did the udder infection when firmly established die out during the three years of observation. The strippings were found to have as high or higher cellular content and antibody content as did the fore milk. The rear quarters of the udder are apparently affected first, probably due to discharges and to the switching of the tail, the infection being then carried to the front quarters by the hands of the milker. The age of the cow did not appear as a factor in the first appearance of infection.

Studies have been made relative to the pathogenicity of *B. abortus* in laboratory animals as well as cattle. The injection of naturally infected milk into rabbits gave no results, and feeding such material showed no pathogenic or antigenic action. Some investigations were made on swine epidemics with the object of finding a method whereby different swine diseases may be differentiated with scientific accuracy and to determine accurately the relation of hog cholera to its complications and to other epizootic or sporadic swine diseases which might be mistaken for hog cholera.

Microbial action on various nitrogenous substances, including dried blood, tankage, cottonseed meal, ammonium sulphate, and sodium nitrate was studied by means of the soil solution as obtained by the oil-pressure method, similar experiments being made of solutions from soils similarly treated. The composition varied with the different periods of extraction, indicating decomposition of the substances in the soil. This was true not only of the nitrogen, but of the total solids. It is believed that the changes in the soil solution may serve as an index to the biological changes in the soil.

The measurement and classification of the different forms of moisture in the soil by means of the dilatometer have demonstrated

the value of this method in showing that the moisture may cease to be free, as indicated by its not freezing, in measuring the amount of this moisture, in determining under certain empirical conditions the wilting coefficient of soils, and in classifying the condition of water in the soil into free, capillary, physically absorbed, and chemically combined. The results obtained from the study of the concentration of the soil solution by means of the freezing-point method showed that the lowering of the freezing point of soils is entirely different at very low and very high moisture content in different soils and that the freezing point lowering is quite small at the high-moisture content, while at the low-moisture content it is very high. Various other soil problems are under investigation, including the velocity of the reaction between soils and chemical agents, which is found to be so rapid as to be almost instantaneous; also absorption in relation to osmosis in soils and its relation to soluble fertilizer salts and the organic nitrogenous compounds of peat soils.

Studies were made on the absorption of solutions by plants from balanced solutions with the object of working out a practical method of soil fertilization from a physiological standpoint. Plants were grown in a series of solutions having the same total concentration but different proportionate amounts of potassium acid phosphate, calcium nitrate, and magnesium sulphate, the 3 salts being divided into 10 equal parts and varied on this basis. The best growth was secured from a solution containing the salts in the proportion of five parts of potassium acid phosphate, three parts of calcium nitrate, and two parts of magnesium sulphate. Soil solutions were then prepared and analyzed for the purpose of determining how this solution could be improved by the addition of the proper proportion of the above three salts. As an example, one soil showed that it should have additions in the proportion of seven parts of potassium acid phosphate, one part of calcium nitrate, and two parts of magnesium sulphate. This soil evidently lacked potash and phosphoric acid.

Some interesting results have been obtained in an attempt to find a biological method for the identification of molds and fungi. It was found that guinea pigs sensitized with small doses of preparations from the various fungi when given slightly increased doses showed anaphylactic shock reactions. This only occurs when the same fungus is used as in the initial injection. The results show that the method can be applied with definite results and the details are being standardized.

Work with Hatch and other funds.—The department of bacteriology was largely engaged in emergency work. Several outbreaks of supposed hemorrhagic septicemia were positively diagnosed by finding the organism. It was found that complement fixation gave reliable results, the agglutination test proving unsatisfactory.

The celery industry in the Kalamazoo section was seriously threatened by a bacterial disease. It was found that steaming the soil prevented further trouble, but a disastrous flood early in the season scattered the disease so widely that this method of control became impracticable, and efforts are now being directed toward producing disease-resistant plants. Diseases of the bean have received attention, especially anthracnose, blight, and mosaic disease. The spores of anthracnose and blight live over in the soil. Seed infection is usually so deep that disinfection offers little promise, the best chances of relief being the selection of clean, disease-free seed. Seed has been sent to Idaho, where it is hoped the climatic and environmental conditions may keep it free from the disease. Seed from this crop were generally free from anthracnose, only one locality in the State reporting its presence from a wide distribution of the seed.

The mosaic disease of the bean was very prevalent. It is believed to be due to seed-carried infection. It was found to be spread by handling diseased plants and by insects. An effort is being made to secure resistant strains by selection. Other lines of work of the botanical department have included the cucumber mosaic disease, the *Fusarium* wilt of potatoes, and ginseng nematodes. Resistance to the latter by plant selection is sought for. Trials have been made of cabbage seed of strains resistant to the yellows.

A method of treating seed grain with concentrated formaldehyde has been perfected. The concentrated solution is applied to the grain by a sprayer, shoveling it over and into a heap, when it is covered with a canvas for four hours, after which it is spread and aired for a few hours before sowing. By this method a pint of the concentrated solution will disinfect 50 bushels of seed. It works equally well with oats. The organism causing the stem-end rot of watermelon and the bacterial leaf spot of barley was studied. Blackleg disease of the potato was found to be present in the State.

Tests of various insulations for double-walled beehives were made in order to carry bees successfully through the cold winters of the State. The significance of white mold on the cocoons of the tamarack sawfly and its possible relation to the life of the insect are being studied. It was found that the gooseberry plant louse is the cause of abnormal blossoms in certain varieties, and means for its control will be sought for. Further studies are found to be necessary for the control of the rose midge of greenhouses, which can not be killed by fumigation or spraying, and also of the bean maggot, against which early plowing under of the plants on which it occurs did not prove sufficiently effective. Observations on the potato tortoise beetle showed that the pest can be controlled by spraying with arsenicals. Attention was also given to the bean aphid, potato aphid, woolly aphid, and the root maggots of the cabbage and onion.

Studies on the construction and composition of concrete tile have yielded definite information in regard to overcoming losses due to drainage water. A study of lime-sulphur solution showed that there was no free lime in a properly made solution.

Investigations relative to the production of willow withes for furniture making are carried out in cooperation with farmers, and the productive value of different strains is being noted. The influence of the number of buckets as related to the size of the tree and the effect on the flow of sap, the effect of tapping on the wood, and the cost of production of maple sugar were studied.

The preparation of food rations for poultry to eliminate wheat, if possible, is being tried; also, the establishment of a system for the detection of nonproductive hens in the flock, the effect of simple and complex mashes on egg production, and problems on incubation and brooding are lines of work being undertaken by the poultry department.

The possibility of wintering breeding ewes without grain until about one month before lambing was proved. The feed used consisted of about 3 pounds of silage per head with bean pods. The lambs were strong and a number of twins were produced. Lambs from ewes fed clover hay during the winter were no better than those fed silage. It was found possible to partially pasture off alfalfa with hogs and still produce some hay. By using alternate lots for pasturing two cuts of hay were secured, the hogs consuming about half the crop.

Breeding pears and peaches is being carried on to produce fruit suitable for Michigan conditions and resistant to disease, also hybridizing apples, pears, peaches, plums, and grapes for the purpose of fixing definite characters. A number of orchard experiments were also carried on in heating, spraying, and the use of cover crops.

Soil studies on the composition and concentration of the soil solution as indicated by the lowering of the freezing of the roots and tops of plants show among other results that the soil solution and the root sap of plants approach each other in concentration at or near the critical low-water content of the soil. The freezing point lowering of a given crop growing in widely different soils of high water content differed but slightly, but different crops growing on the same soil under similar conditions varied appreciably in this respect. Crops may be subjected to sudden and wide variation in the concentration of the soil solution during the growing season. It was found that the soluble salts moved from regions of high to low concentrations in moist soils, the rate being rather rapid. The rate of movement is affected by the water content of the soil and the amount of salt present. The translocation of soluble salts in the soil is brought about by means of diffusion, by reactions taking place in the soil, and by moisture movement. A definite relationship was

found to exist between the ratio of calcium to iron and alumina, soluble in fifth-normal hydrochloric acid and the soil reaction. In all acid soils this ratio was found to be above 1:1.3 and in all alkaline soils below this figure. The amount of lime required to neutralize an acid soil may be determined by computing the amount necessary to bring the ratio up to 1:1.3.

In an experiment on sowing barley and clover together, the best proportion was found to be 6 pecks of barley, 3 pounds of red clover, and 2 pounds of alsike clover. Substituting oats for barley in this mixture did not give as good a yield. The thinner the nurse crop, the better is the stand of clover secured. Sowing alfalfa at different dates from May to September gave results favoring the earlier as compared with later sowing. The station is making special efforts to increase the wheat production of the State by emphasizing the necessity of sowing the best varieties obtainable.

Plant-breeding work has demonstrated the value of the Robust bean as being better adapted to Michigan conditions than some of the more common varieties grown. It holds its flowers longer than other varieties and has marked disease-resistant properties. It does best on light soils. Rosen rye, which was distributed in 1912, has now largely replaced other varieties. Red Rock wheat also has a large acreage in the State. The highest yield reported for the past year with this wheat was 51.9 bushels per acre. Yellow berry has given some trouble and is being studied. Observations were made on the growth and value of soy beans, Sudan grass, timothy, and other forage crops.

The following publications were received from this station during the year: Bulletins 267 (second edition), Michigan Weeds; 276, Commercial Feeding Stuffs; 277, Studies in the Cost of Market Milk Production; 278, Fertilizer Analyses; Technical Bulletins 25, The Leaf-spot Disease of Tomato; 27, The Freezing Point Method as a New Means of Determining the Nature of Acidity and Lime Requirement of Soils; Special Bulletins 78, Christmas-tree Plantations; 79, Michigan's Shifting Sands—Their Control and Better Utilization; Circulars 29, Infectious Abortion in Cattle; 30, Cucumber Growing; 31, Red Rock Wheat; 32, Barley Improvement; and the Annual Report for 1916:

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation.....	22,000.00
Sales.....	4,779.18
Fees.....	16,807.26
Miscellaneous.....	320.17
Balance from previous year.....	6,984.31
Total.....	80,890.92

The research work of the Michigan station, although hampered by the loss of workers from the staff, continued to make satisfactory progress generally, and its results to give promise of immediate application in science and practice. The station is extending its organization to include further lines of work of interest to the agriculture of the State.

MINNESOTA.

Agricultural Experiment Station of the University of Minnesota, *University Farm, St. Paul.*

A. F. WOODS, M. A., D. Agr., *Director.*

Owing to the war situation large demands were made on the station staff for increased advisory and extension work and the study of special food production and conservation projects. Immediately after war was declared the experimental work of the station was ordered to be subordinated to the emergency needs of the Nation's food supply. A large amount of propaganda work for increased crop production and the distribution of advisory information in methods of food conservation was carried out, and the research and experimental projects which had for their immediate purpose the increasing of food production were pushed forward as rapidly as possible. Special efforts have been made, however, to avoid any disorganization of the research work.

The principal changes in the staff were the resignation of Director A. F. Woods at the close of the year to accept the presidency of the Maryland State College of Agriculture and the appointment of R. W. Thatcher as dean of the college of agriculture and director of the station in his place. E. Louise Jensen, the mycologist, resigned and was succeeded by F. Jean MacInnes. Dr. C. P. Fitch was appointed animal pathologist and bacteriologist in charge of the division of veterinary medicine. Several changes occurred among the research assistants, but the work of the station progressed without serious interruption.

From State appropriations \$151,000 was available for work at the university farm, of which \$115,800 was used in the various station projects. This, with the appropriations made for the support of the substations, gave a total revenue, exclusive of the Federal funds, of \$242,000. A field house for the plant pathology division was added to the station equipment.

Adams fund projects.—Studies on the strength of wheat flour included the diastatic enzymes and the absorptive power of gluten for enzymes of all types, also a study of the colloidal inhibition of gluten from flours of various strengths when acted upon by different electro-

lytes. Investigations on the chemistry of disease resistance in plants are being conducted along two lines—the rate and quantity of growth under normal and abnormal conditions and the chemical composition of the proteins in different parts of the wheat plant under normal and abnormal conditions of growth.

The effect of rust on stem activity is being studied from the photosynthetic activity of wheat stems deprived of their leaves. Attempts are being made to grow rusts on media other than their hosts. The rate and quantity of growth of plant tissue, the oxidase condition of normal and abnormal plants, and the effects of various anesthetics and chemical stimuli on oxidase development are being investigated. Studies of the rusts of cereals are being made on the biological forms of stem rusts on grasses and cereals and their relation to soil conditions. Pathological, morphological, and physiological studies of rusts are in progress, also the effects of soils, moisture, and fertilizers on rust infection. In this connection some highly rust-resistant strains have been secured which are being given a wide test.

Nutrition studies have been carried on for eight years, 32 high-bred dairy steers now being used in this project, dealing especially with the relation of nutrients to meat production. Similar studies are to be taken up with swine.

Investigations on the inheritance of fruit characters were made on the blackberry, plum, grape, and strawberry. In connection with this work studies have been made on sterility and pollen abortion. Pistil sterility was found to be very common. The nature of hardiness is under investigation, including the relation of sap density to winter-killing.

Work on the specific toxicity of various chemicals to insects and their hosts showed that the toxicity of organic compounds is more dependent on the degree of volatility than on the chemical composition, low-boiling compounds being found to be more toxic than those having a high boiling point. Some very promising new insecticides have been found. Chloropicrin and furfural were found to be highly toxic to insects and not injurious to plants or higher animals. It is believed that chloropicrin will prove valuable for grain fumigation and furfural for ridding living plants of insect pests. A special study was made of possible insecticides for use against vermin in Army camps and trenches.

The movement of water in coarse sand and peat soils was found to cease when the amount of water in the soil was reduced to 1.5 times the hygroscopic moisture. Boring with soil augers gives practical indications that crudely approximate laboratory determinations. If the soil sticks to the auger its water content is 1.5 or more times the hygroscopic moisture. If it does not stick, the subsoil moisture is liable to be too low for the successful growth of plants.

Work with Hatch and other funds.—Pot and field experiments on peat soils show that these are deficient in phosphates, that there is usually sufficient lime, and also that they generally carry enough potash for two or three years' cropping. The State has appropriated \$6,000 for three experimental fields of peat soils.

The division of agricultural chemistry has been studying the effect of various gases on the ripening of fruit and the subject of fruit storage, also the cider and vinegar qualities of Minnesota apples. Some varieties do not produce vinegar, apparently due to a low sugar content. Experiments with commercial fertilizers at the central and all of the substations indicate that phosphate fertilizers have thus far failed to produce sufficient crop increase to make their use profitable. Experiments on liming alfalfa indicate that on certain soil types liming is a very profitable practice.

A weed garden has been started which is proving useful to determining their succession. A weed survey is being made of the State and a collection of weed seeds is kept which is used for purposes of identification. The seed laboratory, supported wholly by State funds, has not only done a large amount of regulatory work, but has carried on investigations of various kinds, including methods of testing flower seeds, the longevity of seeds, and the effects of sunlight on germination.

Various problems in plant diseases have received attention, among others the resistance of the spores of corn smut to unfavorable climatic conditions and the effects of the silo on the spores. The loose smuts of cereals can be controlled by soaking in formaldehyde solution for at least two hours at 20° C. Plum pockets, gray-bark disease of the raspberry, and a disease which has made its appearance on oak trees have been studied. The latter appears to be due to a combination of factors. The campaign for the eradication of white-pine blister has been actively carried on. The fungus has been found occurring on both *Ribes* and *Pinus*. The pines in the infected region have been cut out and burned over an area of more than 200 acres. The survey work indicates that the infection is more widespread than was at first suspected.

Entomological studies on mill and elevator insects and their control are being conducted, also on the house fly, the mosquito, the stable fly, and the horse fly, the latter in its connection with swamp fever. Some miscellaneous investigations include experiments for the control of orchard pests, a study of the injury to maple trees by tangle-foot, the life histories of the oak girdler, the two-lined chestnut borer, and the strawberry weevil. A life-history study of the organism causing blackhead of turkeys is also being made.

The plant-breeding work has developed several strains of pedigreed grains, which have been propagated and distributed. Special selec-

tions of alfalfa, timothy, millets, grasses, and soy beans are being propagated. Detailed studies have been made of the effect of "topping" sorghum canes on the position of the juice and the effect of frosting and of anesthetics on the cyanogenetic compounds of sorghum. Sugar-beet seed production has been successfully accomplished, but it is doubtful if economic returns can be secured under normal conditions. Growing grains in mixtures for feed crops has proved very successful.

Corn and soy beans grown together for silage production have done well, and a study has been made of distance of planting and stage of maturity for cutting. Investigations are being made on the time, method, and rate of seeding alfalfa, clover, and peas, and of growing legumes for pastures and for soil improvement. Corn breeding for high and low protein content is being carried on. High protein content is considered recessive and should be readily segregated. Extensive trials in plant breeding and selection of cereals and vegetables are in progress and a number of promising new strains have been developed not only in improved quality but also in disease-resistant properties.

Studies on the cost of farm-crop production, farming on cut-over lands in northern Minnesota, and on farm tenancy and leases promise some valuable and interesting results in regard to profitable farming.

Pig-feeding experiments have been conducted to compare corn and barley, supplementing each with tankage and silage, for fall feeding and also to study pasturage with supplemental feeds for spring feeding. Other work in this line included hogging off corn, the efficiency of self-feeders, pasturing dry sows with a minimum grain ration, and breeding with reference to type and conformation.

Poultry investigations along various lines are being carried out, including the feed cost of raising chickens with self-feeders, the cost of poultry housing, labor cost of poultry raising, and the mortality of chicks.

Over 1,000 tests were made in actual field work of the three generally recognized tuberculin tests used either singly or in various combinations. The results show that certain tuberculous cattle will react to one of the tests and not to one or more of the others and that any combination of two or more tests is a more accurate indication than either test alone.

Investigations of the enzymes in the saliva of the ox and horse show very different activities of these two secretions, the saliva from the horse being strongly amylolytic, while that from the ox has only slight starch-digesting properties. Hog-cholera studies have been made on the lesions produced, the bacterial flora of antihog-cholera serum, duration of virulence of buried cholera carcasses, and the production of a clear, bacteria-free, concentrated serum. A study of the

normal physiology and histology of pigs' blood and internal secretions and of the blood as affected by various diseases is being made. Methods of detection and of transmission of swamp fever are receiving attention. Nearly 2,000 queen bees of improved breeding were produced at the station and distributed to bee keepers throughout the State.

The change of environment showed its effect in the degeneracy of the potato tuber, but the specific cause of this has not been found. Extensive experiments in blueberry culture for northern Minnesota were inaugurated.

The following publications were received from this station during the year: Bulletins 155, Investigation in Animal Nutrition Beef-production—I, Feed Requirements; II, Feed-cost of Production; 156, Cooperative Live Stock Shipping Associations in Minnesota; 157, Labor Requirements of Crop Production; 158, Potato Diseases and Their Control; 159, Second Annual Seed Laboratory Report, 1914-15; 160, Rye Smut; 161, Labor Requirements of Live Stock; 162, The Cost of Living on Minnesota Farms, 1905-1914; 163, Investigations in Cost and Methods of Clearing Land; 164, Farmers' Elevators in Minnesota, 1914-15; 165, Third Annual Seed Laboratory Report, 1915-16; Reports of Northeast Demonstration Farm and Experiment Station, Duluth, 1915, 1916; Report of the Superintendent Northwest Experiment Station, 1910-1916; Report of West Central Substation, Morris, 1915; and the Annual Report for 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation	128,376.37
Sales	79,040.64
Miscellaneous	902.80
⁷ Total.....	238,319.81

The Minnesota station is making most satisfactory progress in its work. A large number of active investigations are being carried on, made possible by the liberal support of the State. The attitude of the institution and of the personnel is toward a high type of research that will be of benefit to the State.

MISSISSIPPI.

Mississippi Agricultural Experiment Station, *Agricultural College.*

E. R. LLOYD, M. S., *Director.*

The station has been very actively engaged in the campaign for increased food production, the director taking a leading part in

this work. A change in the presidency of the college occurred, but the new administration was in thorough sympathy with the station interests, so that no disturbance resulted in its affairs.

The three branch stations are supported entirely by State funds, each receiving annually \$8,500. A cottage costing \$600 was built for the live-stock superintendent, and necessary repairs and fencing were carried out. No changes occurred in the station staff. R. N. Lobdell, assistant entomologist, returned to the station from an absence for advanced study and will devote all his time to research.

Adams fund projects.—Mule breeding has received much attention. The station now has three groups of colts, and from these it is proposed to change the blood to see the effect on inheritance qualities. By using the heavier stallions stock has been built up from native mares for the production of heavy mules, for which there is a growing demand. An elaborate system of measurements of colts is made to determine the inheritance of characters. In crossbreeding the unit characters are split off, and it is thought that a knowledge of these will be of value in horse breeding.

In connection with this project some feeding experiments with brood mares and with young mules were carried out. Three lots of brood mares were used, one lot being fed all the lespeveda hay they could clean up daily; another, equal parts of lespeveda hay and corn and soy-bean silage in such amounts as were cleaned up daily, the third lot receiving 1 pound of corn per hundredweight and all the Johnson grass they would clean up daily. All of these rations were found to be satisfactory. The second ration mentioned was the cheapest, the third being the most expensive. Shredded corn stover was found to be a satisfactory roughage for wintering mature mules. For yearling and weanling mules it was found that equal parts by weight of corn and soy-bean silage and cowpea or lespeveda hay did not make quite so satisfactory a roughage as hay alone. Experience has shown that not more than one-third of the hay can be replaced by silage when fed to young mules.

In cotton-breeding experiments about 200 F_1 hybrids, the result of numerous crosses between eight standard varieties, were grown. The characters of these hybrids were studied in comparison with those of the parent strains, and considerable data were collected. In general these hybrids were intermediate between parents in respect to most characters. Several thousand F_2 hybrids from selfed F_1 seeds were grown. These were studied in comparison with the original strains, and certain characters, such as length of lint, percentage of lint, diameter of bolls, and width of leaves, were measured. In conformity with Mendel's law for second-generation hybrids a bimodal curve was to be expected when the characters of the F_2 hybrids were platted. This, however, was not obtained. There appeared to

be a breaking up or separation of characters, but not regular segregation. This may be due to the fact that the parent strains were only relatively pure commercial varieties and not homozygotes in respect to genetic purity. It is evident that hereditary studies must be based on pure lines to be satisfactory, and such have been started with several characteristic varieties. Several selections have been made from the hybrid plants which give promise of commercial value, of which Lone Star 132 and Express are the best. At the Delta substation the money value per acre of seed and lint of this variety has \$108.37, which was \$50.83 more than the parent strains yielded. Corn-breeding experiments have been begun, and a number of hybrids secured which will be used for selection and improvement.

Experiments in green manuring have been continued with interesting results. Cowpeas were used for this test and oats grown as a crop. Increasing amounts of cowpeas were turned under in this series up to 50 tons of green weight or 20 tons of dry weight per acre. The largest crop of oats was secured in the pots in which the highest amount of green manure was turned under, showing that the limit had not been reached. The oats in these pots, however, were not so tall as in some of the others, but were thicker, stooled more, and gave the largest green weight. In general the number of bacteria found in the pots in this series corresponded with the amount of fertility added. Another series was run to compare horse manure with oats and vetch turned under. The results showed that the latter was more valuable than horse manure, ton for ton. The manure, moreover, was found to be entirely decomposed in the soil, while the oats and vetch were only partially so, and besides giving the best crop the first year they will apparently furnish fertility for several years.

Forage-poisoning studies have been made on *Paspalum dilatatum*. This was found to be very commonly attacked before maturity by the fungus *Claviceps paspali*, which caused the diseased heads to produce poisonous symptoms in the animals feeding on them. When subjected to various solvents, as alcohol or ether, a dark-colored oil, which is present to the extent of 10 to 11 per cent, is easily extracted, which contains the poisonous principle, the extracted mass being nontoxic. Five cubic centimeters of this oil administered to a guinea pig produced all the symptoms observed in animals grazing on the grass and usually ended fatally within 24 hours. As yet the poisonous principle itself has not been isolated from the oil. The toxin or toxins do not appear to be distinctly basic, as they are not removable from the oil by treatment with acidified water. The nitrogen content of the oil is very low, which is also indicative of the feebly basic or nonbasic character of the toxin. The toxicity of the oil is not destroyed by heating to 140°. No perceptible compounds can be separated by the usual alkaloidal precipitants.

Work with Hatch and other funds.—Sheep breeding to improve the native stock is showing great improvement in the first cross. Pure-bred Southdown, Shropshire, and Dorset rams are being used for this purpose. Parasitic diseases, especially stomach worms, were found to be very prevalent among the native ewes, and various medicinal treatments with rotation of pastures are being used successfully.

An experiment was conducted to determine the possibility of utilizing certain waste products in wintering breeding cows. One of the most interesting results of this experiment was a demonstration of the value of silage made from cotton stalks. Cotton can not be grown profitably as a feed crop, but it may be salvaged after being severely damaged by the boll weevil when other roughage is scarce. Silage made from cotton stalks cut before the leaves fall had a high feeding value. Animals fed a silage made from cotton stalks and sorghum with a small amount of cottonseed meal gained in weight. Weanling calves wintered on pasture-grass hay made larger gains than those fed sorghum silage as roughage. Fifty head of steers were finished for the market during the winter to determine what part corn can economically play in feeding steers under southern conditions. The results show that corn can be profitably used as part of the grain ration, even when selling as high as \$1 per bushel.

Rotation experiments with silage corn and crimson clover have given excellent results, the clover being planted in the fall and turned under in May, from 10 to 12 tons per acre of green manure being thus supplied to the soil. The results are better than when the clover is cut off as hay. From plats limed three years ago small increased yields are still obtained. The native lime rock gives as good results as other forms. Results from spacing corn and cotton show that thicker plantings give better yields. It was found that commercial fertilizers give very little returns on the stiff soils of the station. Kainit, when applied to cotton three weeks before planting time gave increased yields of cotton. An application at the time of planting gave a small increase, but the earlier applications were more profitable. Subsoiling gave no increase in yield, but deep plowing, 8 to 10 inches, was better than 4 inches. Level cultivation, on well-drained land was better than ridging.

A test of the comparative feeding value of palm-kernel meal, wheat bran, and cottonseed meal for dairy cows showed that cottonseed meal gave the best results and wheat bran the poorest. The palm-kernel meal was not relished as much as the other two.

The use of early spring crops for pasture showed a considerable saving in the cost of feed. A comparison of early and late fall calving indicates that the best results are secured by late fall calving. Experiments to show whether age was a determining factor in cotton-

seed meal poisoning with hogs have not yielded satisfactory results as yet.

The following publications were received from this station during the year: Bulletins 174, I, Feeding Cottonseed Meal and Hulls to Dairy Cows; II, Feeding Value of Cottonseed Meal *v.* Cold Pressed Cottonseed Cake; III, Feeding Value of Purchased Feeds *v.* Pasture *v.* Soiling Crops; 175, Cottonseed Meal—A Good Feed for Laying Hens; 176, The Economy of Mule Production in the South and Methods of Management; 177, Some Experiments and Practical Demonstrations in Hog Feeding at the Delta Branch Experiment Station; 178, Cotton Experiments, 1916; and Technical Bulletin 7, The Soils of Mississippi.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation, including balance from previous year	35,820.13
Fees.....	490.00
Sales	17,367.27
Miscellaneous, including balance from previous year..	6,790.13
Total	90,467.53

The Mississippi station has a very strong following among the farmers and its work is being given wide publicity by the press agency of the college and extension service. It is on a thoroughly practical basis and devoted to sound investigation.

MISSOURI.

Missouri Agricultural Experiment Station, *Columbia.*

F. B. MUMFORD, M. S., *Director.*

The appointment of the director of the station as food-control commissioner of the State necessarily required considerable of his time, but the efficient organization of the institution allowed the work to go on without serious interruption.

There were a number of changes in the staff, many resignations of assistants having been accepted to enable the men to qualify for commissions in the Army. W. C. Etheridge was placed in charge of the department of farm crops and E. W. Lehmann was appointed associate in agricultural engineering. A number of assistants were appointed to fill the vacancies in the various departments.

The income of the station aside from the Federal funds was about \$9,000 appropriated by the State for experimental purposes, \$21,588 for fertilizer control, \$6,500 for soil survey, and \$10,000 for soil experimental fields. No new buildings were added, but several departments improved their equipment during the year.

Adams fund projects.—A study has been made of the effect of cottonseed meal on the physical properties of milk and butter and means of counteracting the undesirable properties. It was found that the oily flavor and softness of the butter could be controlled to a considerable extent by feeding corn silage. Further investigations as to the cause of this correcting effect indicated that the lactic acid in the silage was largely responsible, as alfalfa hay with lactic acid had the same effect. The effect of acetic acid and glucose is to be tried in the same way. Observations were made on the influence of condition at parturition on the composition of the milk and butter fat. A cow in rather poor condition after calving produced milk with 3 per cent of protein and 3 per cent of fat. After 90 days her protein ration was nearly doubled. This caused an increase of several pounds in the milk flow, containing 3.5 per cent of protein and 5 per cent of fat. The experiment is still in progress.

A project on the factors influencing the normal rate of growth in domestic animals and the permanency of the effects of arrested development is being carried on with three lots of steers, one receiving a short, one a normal, and one a maximum ration. The growth of the animals on a maximum and a normal ration was about the same. The lot on the short ration was about 60 days behind the others. An attempt is being made to determine the rate of retardation and whether retarded growth in the skeletal structure is permanent. Studies on age as a factor in animal breeding, which have now been continued through a number of generations, show that the growth of the dam is checked by early breeding and if this is continued normal growth will not be attained. The retarding factor is lactation and not gestation.

An investigation on the factors influencing the development of dairy heifers during their growing period upon their subsequent functional activities, size, vigor, and general usefulness, during which complete records of growth as shown by weight and height measurements were made of a number of animals, has established a normal curve of growth that has proved valuable for comparison in other investigations. Results showed that a ration in which about 15 per cent of energy is from protein is sufficient for normal skeletal growth but possibly a little deficient for the best standard as measured by gain in weight. Unfavorable conditions exert their effects more in growth as represented by weight than by development of the skeleton. A correlation was found to exist between the water and fat content of the skeleton, a loss in fat being accompanied by a gain in water.

Studies on hog cholera and the factors concerned in the immunity against the disease and on the duration of the infectiousness of the

blood of swine treated for immunization by the serum-virus method showed that infection in the blood ceased after the seventeenth day. Highly potent hog-cholera serum injected simultaneously with small doses of virus does not prevent the latter from multiplying enormously in the tissues of the inoculated animal. Prolonged or permanent immunity against hog cholera depends upon more or less prolonged stimulation of the protective cells of the body by highly virulent antigen. It was found possible to transmit tuberculosis through the use of a serum from a hyperimmune hog infected with tuberculosis. Experiments also showed it possible to transmit bovine tuberculosis by blood inoculation not only to swine but to a somewhat lesser degree to rabbits and guinea pigs.

Investigations on the factors influencing the development of the corn plant have shown no correlation between any characters and yield. The second third of the growing period is the most important to the final growth from the standpoint of both water and nutrition. The water requirement of the corn plant appears to be constant regardless of the nutrition. Studies are to be undertaken on water penetration, evaporation, run-off, and erosion. The run-off on uncultivated plats is found to be about double that on cultivated ones. Data on evaporation are collected both from plats and lysimeters. It appears that the effect of loosening the soil is more important on increased absorption than on decreased evaporation.

Investigations on the nutrition of orchard and small fruits in relation to disease have been carried on, also fruit production and frost resistance as influenced by fertilization. Nitrogen was found to be the limiting factor for fruit production in the apple orchard in sandy or light loam soils, while on rich soils it delayed fruiting. On medium fertile soils the application of chemical fertilizers was made at a loss. More blight occurred in apple trees that were abundantly supplied with nitrogen. With peach trees nitrogen caused later maturity, the formation of more fruit spurs, and later spring activity and the trees were attacked more readily by the brown rot. There was little difference in the yield between limed and unlimed plats of strawberries. The plants on the limed areas developed a slightly better foliage.

Studies on the rest period of plants are being carried on in relation to the influence of chemicals on this period and fleshy root development of radishes and the breeding of lettuce for the purpose of finding the external and internal influences and internal changes, both physical and chemical, preceding, accompanying, and following the rest period.

A number of varieties of oats have been tested with reference to their susceptibility to the common mildew. So far no variety of oats belonging to the common species has proved entirely resistant

to the mildew. Experiments to determine the influence of nutrition of hosts on susceptibility have been continued with more or less conflicting results.

Mendelian inheritance in domestic animals has been studied in connection with the spangling of fowls, as it was thought that so definite and simple a color pattern would be favorable for genetic analysis. The conclusion has been reached that spangling is determined in inheritance by a distinct factor which behaves in a typically sex-linked fashion, the cocks being homozygous and the hens heterozygous for it in silver-spangled Hamburgs. When spangling is introduced through the male both sexes in the F_1 generation show spangles, while the reciprocal cross gives only spangled males, the females being unspangled and incapable of transmitting the pattern. The spangling may be greatly modified or obscured by other factors, especially factors for black pigmentation. The independence of the spangling factor is shown by the fact that after segregation and recombination of the several factors concerned, some individuals are found in which all disturbing factors are absent and the spangled pattern is exhibited in its original purity. A number of such birds have been obtained from different matings and these now breed as true to spangling as do the silver-spangled Hamburgs themselves.

Work with Hatch and other funds.—It was found that for light horses not at work 5 pounds of alfalfa hay with what corn silage they would consume made a cheap maintenance ration for the winter months, although some of the animals lost slightly in weight. A comparison was made of self-feeders for swine with hand-fed lots, both being on rape forage. The self-fed pigs consumed 4.3 pounds, with a daily gain of 1.05 pounds, and 384 pounds of feed were required to make 100 pounds of gain. The hand-fed lot consumed 3.47 pounds and gained 0.95 pound daily, 365 pounds of feed being necessary to produce 100 pounds of gain.

Steer-fattening experiments to determine the value of nitrogen concentrates and heavy or light silage rations indicate that the use of such concentrates depends largely upon the premium paid for fatter or heavier cattle. A highly satisfactory grade of beef was produced without corn and much was saved by this method of feeding. It was found that with 3.16 tons of corn silage, 750 pounds of hay, and 503 pounds of cottonseed meal or old process linseed meal a choice 3-year-old steer may make a gain of 322 pounds in 130 days. Pig-feeding experiments showed that corn alone is not a sufficiently well-balanced concentrate for developing pigs grazing on rape forage. A combination of corn, shorts, and tankage or corn and skim milk was found to be best. Rape proved to be superior to blue grass for pigs.

The effect of wounding the plant and of inoculating the soil has been tried in connection with the *Fusarium* wilt of watermelons. It appears that wounding is not prerequisite to the entrance of the fungi into the roots and stems. Inoculation of the soil in the greenhouse resulted in a large proportion of the plants succumbing to the disease.

Practically all varieties of oats tested proved to be susceptible to crown rust and oat smut by inoculation. The early maturing varieties showed the greatest resistance. With few exceptions it was found that a host plant that is susceptible to one fungus is also susceptible to others. The percentage of smut was found to be invariably higher in late planted wheat than in the earlier plantings.

The dairy department has made a study of the winter rations for dairy cows. It was found that heifers receiving a ration of silage and timothy hay will be maintained, but will make very little gain in weight. The most practical ration recommended for Missouri conditions is silage or a legume hay for roughage with a grain allowance of about 2 pounds daily. It was found possible to make silage of good quality from leguminous plants provided they were first wilted in the field, thus materially reducing the water content.

The entomological department has developed a new system and key for identifying scale insects. Both dust and sprays have been successful in controlling the striped cucumber beetle. The young nymphs of the squash stink bug were found to be killed by nicotine, but the adults were only stupefied. No remedy was found to be effective for the squash-vine borer aside from hand picking. Further studies on the control of the Hessian fly confirm the recommendations which have been made, to plow under stubble immediately after harvest, cultivate to keep down volunteer wheat, and to seed on or after the fly date calculated for the location. Other projects under investigation are the effect of sucking insects on the host plant, conditions affecting epidemics of insect pests, studies of the apple-leaf hopper, tarnished plant bug, and codling moth.

Eighty-four varieties of soy bean were tested for yield and seed. Best results were obtained from seedlings from June 1 to 15 and drilling at the rate of 42 pounds per acre in rows 8 inches apart. Cowpeas gave the largest yield of hay when drilled at the rate of 5 pecks per acre with rows 16 inches apart. Alfalfa trials gave best results with northern-grown seed. The maximum yield of oats was obtained with a seeding of 12 pecks to the acre. Sudan grass trials give much promise for the future of the crop in the agriculture of the State. Barley was severely winterkilled.

The average cost of keeping work horses on the farm, exclusive of depreciation, was found to be \$90.33. Depreciation begins at the

close of the sixth year, drops slowly until after the tenth year, after which time it is more rapid. The average cost of feeding makes up about 72 per cent of the cost of keeping. For economical management of horse labor, studies showed that a horse should work from 800 to 1,000 hours a year. The average total cost per hour of horse labor for 4 years was 7.65 cents.

A study of wood fence posts and their preservation showed the most perishable woods to be sycamore, basswood, willow, persimmon, cottonwood, birch, dogwood, black oak, red oak, sugar maple, and ironwood. Thirty-five forms of fungi were found to cause decay in fence posts. One brush coat of carbolineum before setting in the ground was of little value in preserving perishable woods. Two coats of creosote lengthens the life of the posts. Treated by the open tank method less than 7 per cent of the posts were attacked by fungus.

The treatment of apple canker by cleaning out and disinfecting the wounds has proved successful.

It is believed that alternate bearing may be controlled to some extent by thinning and pruning. Some hybridization work is in progress to produce an apple for late blooming. Peach breeding to secure a long rest period has been continued. Fall planting proved to be more favorable than spring planting. Root growth does not begin in the former case until after the ground freezes on top. Combined sprays for insects and fungus diseases have been tried. A combination of arsenate of lead and lime-sulphur resulted in fruit of the best keeping quality. From various tests on the use of fertilizers with strawberries nitrogen was found to be detrimental on all types of soils, while phosphoric acid increased the yield up to an application of 225 pounds per acre, beyond which it was not profitable. Potash had no appreciable effect.

A comparison of skim milk and beef scrap for feeding chicks showed the superiority of skim milk. At the end of six weeks the lot receiving the skim milk supplemented to their ration weighed 6 ounces, those receiving beef scrap 4 ounces, while the checks weighed 2 ounces. Protein concentrates of vegetable origin seemed to have no great influence on egg production.

Experiments on methods of applying fertilizers to corn showed that heavy applications in the row are apt to injure the crop. Better results were obtained by drilling the fertilizer ahead of the planting or by applying it at the second cultivation. Crop rotation experiments are now in their twenty-ninth year. It has been found that rotation maintains fertility better than manuring where corn and wheat are the crops used, but where oats and timothy were used manuring gave better results.

The veterinary department has done much work in testing suspected herds for the presence of contagious abortion. A total of nearly 1,600 animals were under observation from 73 herds of cattle, 3 studs of breeding mares, and 4 herds of pure-bred swine. About 35 per cent of the cattle in the suspected herds gave a positive reaction by the complement fixation test. The same antigen was used in testing horses and swine.

A soil survey of the State is being conducted in cooperation with the Bureau of Soils, United States Department of Agriculture, 44 counties out of 114 being now completed.

The following publications were received from this station during the year: Bulletins 140, Size of Farm Business; 142, Successful Farm Organization; 143, Variety Tests of Corn; 144, Self-feeders for Fattening Swine, with Directions for Constructing a Self-feeder; 145, Inspection of Commercial Fertilizers, 1916; 146, Agricultural Lime; Research Bulletins 19, Studies of the Timothy Plant—I, The Influence of Maturity upon the Yield, Composition, Digestibility, Palatability, and Feeding Value of Timothy Hay; 23, The Powdery Mildews of Avena and Triticum; 24, Influence of Plane of Nutrition of the Cow upon the Composition and Properties of Milk and Butter Fat—Influence of Overfeeding; 25, The Influence of the Plane of Nutrition of the Cow upon the Composition and Properties of Milk and Butter Fat—The Influence of Underfeeding; 26, The Nutrients Required to Develop the Bovine Fetus; 27, Effects of Feeding Cottonseed Products on the Composition and Properties of Butter—Influence of the Character of the Ration and Quantity of Cottonseed Products; Circulars 79, Sour Milk for Chicken Feeding; 80, The Missouri Poultry House; and 81, Pruning Shade Trees.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15,000.00
United States appropriation, Adams Act-----	14,999.90
Balance from United States appropriation, Hatch fund -----	.10
State appropriation-----	8,812.78
Fees, including balance from previous year-----	22,196.48
Sales, including balance from previous year-----	39,417.04
Miscellaneous-----	14,673.01
Total-----	115,099.31

The Missouri station has an efficient organization and large resources, enabling it to do a large amount of investigational work devoted to fundamental principles. The value of its work to the State and to the science of agriculture in general is very great and can not fail to meet the appreciation of all.

MONTANA.

Montana Agricultural Experiment Station, Bozeman.

F. B. LINFIELD, B. S. A., *Director.*

Nearly all of the station force took part during the latter part of the year in emergency work of some kind. Such phases of the work as were considered of immediate local application were popularized for distribution. The general condition of the station was very satisfactory and the staff did not suffer any serious changes.

The State support of the station was liberal, the amount appropriated for the biennium beginning March 1 being \$95,250, which was divided up among the central and the substations for maintenance. In addition to this, \$100,000 was appropriated for buildings at Bozeman, part of which is to be used to replace the chemical building which was destroyed by fire. An addition to the grain-inspection laboratory, to cost about \$2,500, is also being made. In connection with cooperative work with the United States Department of Agriculture the latter contributes between \$20,000 and \$25,000. The State board of health appropriated \$5,000 to the entomological department for investigations on the spotted fever tick, the house fly, and the mosquito, and the State board of entomology \$2,700 for minor entomological projects.

Adams fund projects.—The study of correlations and inheritance in pure lines of oats has reached its sixth crop, which is being planted both at Bozeman and at the New York Cornell station, with which the work is being cooperatively carried on. Some minor changes have been noted in these pure lines which it is thought may be due to environment.

Studies on soil nitrates are being made in connection with the utilization of the light rainfall of the semiarid West. Wheat on fallow land was in excellent condition in spite of the dry season, while that on continuous wheat plats was poor. It is thought that continuous cropping may result in greater compacting of the soil, thus hindering nitrification. Nitrates have been found to accumulate under bare fallow if there is carbonaceous material present in the soil to supply energy for the bacteria. Some evidence has been obtained of bacterial activity at a higher nitrate content than was formerly considered possible.

Studies are being continued on the factors that influence the strength of wool. Range-fed ewes produced a somewhat weaker and otherwise inferior wool than those kept at the station and given abundant food. Small but constant differences in wool due to moisture conditions have been observed.

Apple canker was very prevalent during the year, which gave abundant opportunity for the study of this disease. Winter injury weakens the trees and makes them more liable to attack. The fungus, *Cytospora* sp., is only a weak parasite and there is considerable varietal resistance to it. The effects of arsenicals on vegetation are particularly noticeable on transpiration and growth. Plants show a marked difference in their tolerance to arsenic applied in the soil. Studies of the brown spot disease of the bark of fruit trees have failed to show the presence of any causal organism constantly associated with the disease and all attempts to produce it by inoculation have failed. Diseased limbs do not put out buds beyond the point of attack, but scions from diseased limbs grafted on sound stock grow readily.

The life history of the sugar beet louse has been worked out. The control of this pest by irrigation has proved very satisfactory, the infestation being much decreased and the tonnage and sugar content increased by keeping the soil fairly moist at all times throughout the growing season. The results of the season's work on a monetary basis are interesting. After deducting the cost of irrigating it was found that three irrigations, instead of two, gave an increased profit per acre of \$18.28. Assuming that all the beet fields in the district would have given as good results, it is figured that the net earnings would have been increased \$169,157 by the extra irrigation. An important predacious enemy has been found, *Chloropisca glabra*. One maggot of this fly consumed 48 root lice before completing its growth. It was found to frequently destroy entire colonies. This is the first species of the oscinidæ that has been reported as being predaceous in its habits.

The army cutworm, which was very abundant last year, entirely disappeared this season. Other destructive cutworms, however, have appeared in grain and potato fields in the State and will receive attention. The western grain aphid, which has been under study for some years, has disappeared, apparently due to severe winterkilling in localities where it was abundant. Work in progress in the chemical department was temporarily interrupted by the loss of the laboratories and material by fire.

Work with Hatch and other funds.—The department of agronomy has been very successful in selection experiments with grain. One strain of Kharkof wheat has been isolated which gives an increase of 10 bushels over the yield of the original variety and is also hardy and of excellent quality. Very successful experiments are being carried out in growing Russian sunflower for silage. When planted with a grain drill in rows 8 inches apart, the yield was 39.8 tons of silage per acre. This plant grows readily in the higher valleys of the State. If the silage proves to be satisfactory, this plant on

account of the large yield will be a valuable addition to the silage crops of the State. Extensive variety tests are in progress with winter and spring wheat, oats, barley, peas, flax, clovers, and grasses, also with root, fodder, and silage crops, including millet, rape, Sudan grass, sunflowers, and corn.

The animal husbandry department is conducting extensive experiments in feeding cattle, sheep, and swine. Experiments on wintering breeding ewes showed that it required 3.5 pounds of clover hay and 1 pound of beets, or 4 pounds of hay per head daily to keep mature ewes in strong, thrifty condition, with the addition of $\frac{1}{3}$ pound of oats per head daily for 20 days previous to lambing. A comparison of rape, kale, barley, and oats as forage for growing pigs showed that returns from the grain forages were only sufficient to pay the land rental and other costs, while rape and kale gave satisfactory returns over these expenses.

On account of the prevailing high prices for concentrated feeding stuffs a series of experiments to determine the minimum amount of grain that can be fed to growing pigs on forage with maximum profits has been made. The results show that 1 pound of barley per hundredweight for pigs on clover pasture gave cheaper gains than those receiving more or less. A comparison of the relative value of tankage, alfalfa hay, and sugar beets as supplements to barley for swine indicated that under average Montana conditions alfalfa hay grown on the farm gives the greatest net returns. In the wintering of brood sows a comparison was made of feeding sugar beets or alfalfa hay with barley. The latter made slightly greater gains and at less cost than the former. In a study of the cost of wintering breeding beef cattle three lots were used, the first receiving straw only, the second straw and 5 pounds of hay, and the third straw and 10 pounds of hay. All were in good condition at the beginning of the experiment. The general conclusion was that cattle can be wintered on straw alone provided they are fat when going into winter quarters, but a daily feed of 5 pounds of hay in addition brings the cows out in better condition in the spring.

A comparison of Giant Russian sunflower silage with alfalfa hay as a soiling crop showed that 3.5 pounds of the former had the same value as 1 pound of alfalfa hay. Sunflower silage and clover hay with corn proved about equal in value as soiling crops. The cows on the sunflower silage ration showed as good thrift, appetite, and general condition, and no undesirable flavor was imparted to the milk.

Potatoes grown from seed that was partly dry-rotted by *Fusarium* in storage showed practically no rot, indicating that transmission through the seed is unimportant. Field studies of the potato "black-leg" show that this will soon be the most serious potato disease in the State. The plum pocket disease was found to be almost perfectly

controlled by a single application of lime sulphur. A study is being made of the possibility of destroying patches of extremely hardy perennial weeds with underground root stocks by spraying with a solution of sodium arsenite. This promises to be quite effective against salt sage and blue lettuce, but not against the Canada thistle.

The entomological department has been engaged on an investigation on the spotted-fever tick. Studies on the host relationship showed that in eastern Montana the smaller rodents were important as hosts in the early stages of the tick. This will have an important bearing on the control. Control campaigns against mosquitoes have been inaugurated in many places, also against grasshoppers, which were very troublesome in some sections. Poisoned bran was used successfully for this purpose.

Notwithstanding the loss by fire of the chemical building, which destroyed all samples and material under investigation, the department reports some interesting results of a study of the nitrate deposits that occur in the State. The varied conditions under which these are found precludes their formation as solution residues, and the theory is advanced that they are formed by the oxidation of nitrogenous matter present in bat guanos. These natural nitrates contain 80 per cent of nitrate of potash. They are probably formed by bacterial action and the process goes on continuously. They do not occur in sufficient abundance to be of commercial importance.

Farm cost accounting, tractor records, and an account of the depreciation and necessary repairs on farm implements are important lines of investigation that are being conducted by the farm-management department. Accurate data on the use of tractors have been worked out, also the acre requirements for the use of various implements. Other lines of investigation have included sewage disposal on the farm, pumping practice, electrical pumping for irrigation, fence-post treatment, drainage systems, and measuring devices for irrigation water.

Careful records have been kept on the inheritance of the hatchability of eggs, and as a result it has been possible to greatly increase the hatching percentage of eggs set. Studies on the effect of age on egg production show that Leghorn hens can be profitably kept for at least three or four years. Animal food was found not only to increase egg production but when used the food cost per dozen eggs was greatly reduced. Skim milk gave the highest average annual egg production, followed by meat scrap, cut bone, and fish scrap. During cold weather, however, green cut bone gave the best result. Crate feeding roasters was found to be profitable, forced feeding with wet mash for 3 weeks before marketing increasing the weight from 17 to 25 per cent and greatly improving the quality of the meat.

In a study of hairless pigs it was found that the percentage of iodine was always lower than in normal pigs and that this could be increased by feeding iodine salts.

Straw mulch in comparison with cultivation in dry-land gardening showed that with very few exceptions a 4-inch mulch of straw reduced the yield, especially in warm-season crops. Cauliflower, however, gave better results when mulched. Mulching conserves more moisture than cultivation but reduces the soil temperature. Placing celery plants in cold frames early, thus subjecting them to cold but not freezing temperatures, gave the highest percentage of seed stalks. Variety tests of everbearing strawberries showed that Progressive passed the winter best, but Senator Dunlap was the most promising commercial variety. Many variety tests of vegetables were carried on. It was found that cabbage kept best when stored in pits without removing the roots. Thinning potatoes to one stem to a hill reduced the total yield of marketable tubers, but also reduced the percentage of culls and improved the marketable tubers. Early thinning is important.

The following publications were received from this station during the year: Bulletins 108, Second Annual Report of the State Grain Laboratory of Montana; 109, Thirteenth Annual Report of the State Entomologist of Montana; 110, Dry Farm Grain Tests in Montana; 111, Profits in Farming on Irrigated Areas in the Gallatin Valley, Montana; 112, Fourteenth Annual Report of the State Entomologist of Montana; 113, Third Annual Report of the State Grain Laboratory of Montana; 114, Report of the Work of the Horticultural Substation; 115, Investigations of Irrigation Pumping Plants; Circulars 12 (Supplement), Some Points in Fan Weed Control; 51, Poisonous Plants and Stock Poisoning on the Ranges of Montana; 52, The Army Cutworm in Montana; 53, Corn in Montana; 54, Selecting and Curing Seed Corn; 55, Blasting Ditches; 56, Artificial Brooding and Chick Feeding; 57, Tuberculosis in Poultry; 58, Sclerostomes in Horses; Special Circulars 3, A List of Breeders of Pure-bred Live Stock in Montana; 4, A List of Breeders of Standard-bred Poultry in Montana; and the Annual Report for 1915.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15, 000
United States appropriation, Adams Act.....	15, 000
State appropriation.....	66, 000
Individuals	2, 000
Farm products	8, 000
Total.....	106, 000

The station is in a flourishing condition. All of the work seems especially well planned in its relation to important questions connected with Montana agriculture.

NEBRASKA.

Agricultural Experiment Station of Nebraska, Lincoln.

E. A. BURNETT, B. S., *Director*.

No marked changes interrupted the progress of the station throughout the year, although, as is the case with most stations, the war resulted in some changes in the staff. The work, however, was not seriously crippled. C. B. Lee, animal husbandman, resigned and was succeeded by H. J. Gramlich. J. W. Calvin, associate in agricultural chemistry, was granted leave of absence to serve in the National Army. The agricultural editor, Floyd Wambeam, resigned to enter the Army and was succeeded by R. P. Crawford. E. G. Woodward resigned to accept a position in the Nevada Experiment Station. G. K. K. Link is on leave of absence with the United States Department of Agriculture.

The State legislature appropriated for the biennium beginning April 1, 1917, \$25,000 for the central station, \$63,000 for the North Platte substation, \$8,000 for the Scottsbluff substation, and \$11,500 for the Valentine substation. Special appropriations for experimental purposes were \$32,000 for an agronomy farm near the central plant, for which purpose 160 acres have been purchased, \$10,000 for a fruit-demonstration farm, for which 80 acres have been secured near Union, and \$10,000 for investigations in animal diseases.

The new dairy hall has been completed and equipped at a cost of approximately \$200,000, and a new agricultural engineering hall, to cost approximately the same, is in process of erection. At the North Platte substation an electric-light plant, pit silos, root cellars, and an irrigating pumping station have been completed, at a cost of \$3,860.

Adams fund projects.—A new disease of the potato, a *Fusarium*-stem end rot, was discovered during the year and has received much attention, together with *Fusarium* wilt. Removal of the diseased stem ends was found to greatly reduce the former. Much progress has been made toward securing resistant strains, 273 of which are under trial. Examination of these indicated either varietal resistance or that infection arises solely from the seed piece. Further studies on diseases of the potato included leaf roll and related diseases. Leaf roll appears to be accompanied by physiological weakness, which apparently makes the plant more subject to other diseases. Attention was also given to the life history and pathogenicity of *Rhizoctonia* of the potato. The study of the life history of the apple-blister canker, *Nummularia discreta*, was completed and methods of control are being investigated, also the cause of its spread within the tree and its outbreak on the surface.

Some work is being done on the chemical nature of the purple and brown coloring matter of corn. The purple color was isolated and appears to be a glucosid, the brown color apparently being an oxidation product of the purple.

Silage investigations were conducted with alfalfa alone and mixed with sorghum. Total acid, volatile acid, and lactic acid were determined, and also the gaseous products in normal and in chloroformed silage. In the latter, gas production was normal while acid production was reduced. Good silage was obtained when alfalfa was sprinkled with lactic-acid cultures at the time of storage.

Results of a study of the organic constituents of the soil tend to minimize the importance of the toxin theory. Toxicity varies with different soils and is correlated with the absorptive power of the soil. Vanillin and coumarin were found to be less toxic in soils than in solution, the toxicity apparently disappearing after a time in the soil. Quinone was first toxic, then stimulating. Dihydroxystearic acid showed a high toxicity, which appeared to be due to the acidity, as it was corrected by liming.

The horticultural department has been engaged on the problem of winterkilling, especially the temperature of maximum injury in wet and dry soils. The relative rate of temperature change at different depths in wet, medium wet, and dry soils showed that while the rate of change was somewhat more rapid in dry than in wet soil, the minimum temperature in the wet plat after 12 hours was as low as that in the dry. By artificial freezing processes, under control, it was found that a temperature of -10° to -15° F. for 2 hours or longer will injure and often kill young apple roots. These temperatures are frequently reached at a depth of from 6 to 10 inches in unprotected soil during cold periods. Ten varieties of 2-year-old apple trees were frozen to compare the relative hardiness of the scion roots and the stock roots of the same tree. In most cases it was found that at from -10° to -15° the portion of the root system coming from the stock was killed, while the roots produced above the union were only injured. A difference of temperature of 20° was found between mulched and unmulched soils at a depth of 3.5 inches in the late afternoon on hot days, the mulched soil being the cooler. Mulched soils were much more even in their temperature near the surface than unmulched soils.

The department of entomology has made a study of alfalfa pollination by insects and considerable work has been done on the life history of several common cutworms, especially the dingy and the clay-backed cutworms.

Various degrees of inbreeding maize have been tried, with largely negative results. Inbreeding has produced rapid deterioration. Crossing pure strains restores vigor but not always beyond that of the parents.

Extensive studies have been carried on to determine the water requirement of different crops and with different types of soils. For this purpose 450 potometers, holding approximately 250 pounds of soil, were used, in which normal growths of corn, sorghum, and other plants were obtained. Transpiration from a given leaf area of corn was found to be approximately one-third of the evaporation from a free-water surface of the same area. Transpiration was less than evaporation at night and the daily variation was very marked. The water requirement per pound of dry matter was found to be much larger in infertile than in fertile soils, but increasing the fertility of the soil increased the amount of water required per plant, due to the increased plant growth. It was found that any factors which cause malnutrition result in a relatively high water requirement in the production of dry matter, because of the continued use of water without a normal increase in dry matter. Transpiration appears to be a purely physical phenomenon, depending primarily upon the moisture supply in the leaf and the climatic condition, which is modified in some degree by temperature changes within the leaf resulting from chemical activity, transpiration, and the absorption of radiant energy. There was found to be no definite water requirement which is constant for any one kind of crop.

A study has been made of the effect of thickness of stand on the growth and yield of cereals, and a comparison of the size of seed with vigor of sprout and yield with wheat and oats. The loss of seed substance in sprouting was quite accurately measured by the carbon dioxid produced. Equal yields were obtained from equal weights of large and small seeds, but not from the same number of seeds of each, when grown in competition. Plants from large seed have a slight advantage in yield over those from small seed, and this may be useful as a natural means of improving crops. The yield of grain from small seed planted in competition with large was 24 per cent smaller; when planted alone it was 11 per cent smaller.

Work with Hatch and other funds.—In a long series of comparative crop tests, extending over some years, it was found that the actual error often did not agree even remotely with the calculated "probable error," which has led to an exhaustive study of the amount of, the causes, and the methods of eliminating experimental errors in comparative crop tests.

In the agronomy department work has been continued on variety tests, and rotation, culture, and fertilizer tests with corn and small grain. Variety tests with oats, extending over 15 years, have shown that for this State the early varieties are better adapted and yield more than the late varieties. A 12-year average of 3 early varieties gave 11 bushels per acre greater yield than from late varieties. An

improved White Kherson strain of oats, known as "Nebraska No. 21," has been grown for distribution. Results with soy beans have demonstrated that except in favorable seasons it is not profitable as a grain crop in Nebraska.

Extensive studies in the field of animal husbandry have been made. In studying the rations for fattening lambs a comparison was made of light, medium, and heavy feeds of corn with alfalfa hay and with corn silage, also with the addition of oil meal, cottonseed meal, and cold-pressed cottonseed cake for the purpose of ascertaining the amount of corn, when fed in conjunction with the above-named feeds, which was necessary for the production of 100 pounds gain, also the advisability of adding silage or a concentrated protein feed to a corn and alfalfa ration. In this experiment the largest profit and the cheapest gain was secured from feeding corn, alfalfa, and silage; the next largest from a full corn ration.

Fifty steers were fed on different rations to determine the relative cost of gain when alfalfa hay and corn with different protein supplements were used as compared with alfalfa hay, silage, and corn, and also comparing heavy feeding from the beginning of the experiment with medium or light grain rations for the first 60 days and heavy grain rations during the finishing period. The highest net profit per steer was with shelled corn, alfalfa hay, and cottonseed meal, but other experiments have not always shown such advantage in the use of cottonseed meal when alfalfa hay was fed as a roughage. Increasing the protein concentrate generally increases the rate of gain and frequently increases the bloom and sale price of the animal, in which case its use is profitable. If only a small amount of protein concentrate is to be fed, it should be given during the latter part of the feeding period, since it will stimulate the appetite of the animal, increasing the amount of grain consumed and also the rate of gain.

The horticultural work has covered a variety of topics. Tests of methods of treating blister canker of apples were rather unsatisfactory, with the exception of cutting out the diseased part, using wound covers to prevent infection. Spraying with Bordeaux or lime-sulphur has been found to inhibit the spores as well as to furnish some protection to wound surfaces. Varietal susceptibility and the length of time an infected tree may live and bear are receiving attention.

Experiments in orchard culture have been in progress for several years. Clean culture with cover crops in midsummer seemed best suited to Nebraska conditions. Breeding to produce improved strains of fruits, particularly apples, pears, and small fruits, has been under way and numerous crosses have been made with promising results. About 50 strawberry hybrids have been secured, also crosses between 24 commercial varieties of tomatoes, showing increased vigor

over the parents. Similar work is being done with lettuce, eggplants, peppers, and garden peas.

Some very interesting and detailed farm-management studies, as applied to eastern Nebraska, were made, and attention was also given to the marketing of apples. A plant-disease survey of the State is being made in cooperation with the Bureau of Plant Industry of the United States Department of Agriculture. The three experimental farms at Scottsbluff, Valentine, and North Platte are well supported by State funds and are doing excellent work in questions arising in their sections in beef, pork, and crop production and in fattening lambs. At Scottsbluff a demonstration herd of dairy cattle is maintained.

The following publications were received from this station during the year: Bulletins 156, Farming Practice in the Sand Hills Section of Nebraska; 157, Farm-management Studies in Eastern Nebraska; 158, Why, When, and How to Spray; 159, Pork Production on Irrigated Lands in Western Nebraska; Research Bulletins 6, Transpiration as a Factor in Crop Production; 8, The Colloidal Swelling of Wheat Gluten in Relation to Milling and Baking; 9, A Physiological Study of Two Strains of *Fusarium* in Their Causal Relation to Tuber Rot and Wilt of Potato; 10, Spraying Experiments in Nebraska; Circulars 2, Pump Irrigation in Nebraska; 3, Cooling Tanks and Milk Houses as Factors in Cream Improvement; and the Annual Report for 1915.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation for substations, including balance from previous year.....	53,834.17
Farm products, including balance from previous year..	70,715.68
Miscellaneous.....	5,135.35
Total.....	159,685.20

The work of the Nebraska station has, as formerly, been applied along lines of direct interest to the agriculture of the State, which it has been instrumental in materially and very evidently improving.

NEVADA.

Nevada Agricultural Experiment Station, *Reno.*

S. B. DOTEN, M. A., *Director.*

The Nevada station has felt the effect of the disturbed condition of the college, which culminated in the resignation of the president and the election of a new board of regents. It has, however, made good progress along lines of vital importance to the agricultural and live-stock interests of the State.

The State appropriation for the station amounts to \$1,000 per year. An insectary was built in Antelope Valley for the study of biting flies of horses and cattle. No serious changes occurred in the station staff during the year.

Adams fund projects.—The snow-survey studies in relation to forecasting water supply for irrigation purposes have been concluded as a station enterprise. Mountain snows are the source of practically all the water used in irrigation in the State. Improved methods of snow surveying and measuring have been worked out. The best courses for measurements in snow surveying were open plats, protected by encircling slopes and forests. It is found the snow cover on the mountains does not necessarily indicate the stream flow to be expected, as certain types of weather during the melting period may exercise an important influence on the amount of water that ultimately makes its way from the snow fields to the streams below. The application of this project lies in the feasibility of forecasting early in the spring with certainty the amount of water which will be available for late irrigation.

Studies on alfalfa have this year been on the oil and the saponins. The saponin is a true glucosid, is soluble in water giving a strong foam on the surface and, unlike other saponins, it is nontoxic and does not hemolyze blood. The ash is very rich in sodium and potassium salts. The principal work of the chemical department has been a study of the poisonous properties of the death camas, *Zygadenus intermedius*, and other range plants, including the lupines, goldenrod, and rabbit brush. The death camas is poisonous at all stages of growth, also all parts of the plant, especially the leaves prior to blooming. Per unit weight of material the flowers are the most poisonous. The bulbs are also poisonous at all times, but are buried so deep in the ground that they play no part in the poisoning of range stock. The active poisonous principle of the lupine is found in the seed. A small amount of lupinin hydrochlorid was obtained in crystalline form. Owing to climatic conditions lupines frequently fail to set more than a third or a half of the normal amount of seed, and most of the seeds are wholly or in part destroyed by worms, which seems to account for the belief among sheep men that at certain seasons lupine patches on certain ranges can be grazed with impunity.

No alkaloids were found in the goldenrod and it is believed that the injury to stock from this plant is due to the very high potash content of the plant. Feeding experiments with the leaves showed them to be injurious to sheep, but extracts from them were without effect on rabbits. Heavy losses were reported from a flock of sheep that had been herded where rabbit brush (*Tetradymia glabrata*)

was the only conspicuous plant, 1,100 being lost. The sheep had browsed extensively on the tips of the twigs of this plant. A considerable amount of this material macerated and fed to a sheep was fatal. Analysis showed the ash of the twigs to contain 25.9 per cent of soluble potash equivalent to 2 per cent of chlorid of potash in the green twigs and it seems probable that this is the cause of the injurious effects.

The project on equine anemia was largely inactive, owing to lack of material. The disease appears to be dormant in the State and it can not be produced experimentally at will. Investigation of an unidentified disease occurring among cattle grazing largely upon wet meadow lands along the eastern slopes of the Sierra Nevada Mountains points strongly to the conclusion that it is an obscure form of hemorrhagic septicemia. Five strains of *Bacterium bovis-septicum* have been isolated. The good results obtained by the administration of a serum prepared by hyperimmunizing horses to these organisms go far toward establishing the diagnosis. Over 5,000 cattle have been inoculated with apparently satisfactory results. The work of the past year indicated that vaccines will give a high degree of immunity, that serums may be successfully used in the cure of the disorder, and that control may be effected largely by drainage.

Work on hog-cholera serum purification showed that the protective principle can be precipitated with the globulins with ammonium sulphate solution. The precipitated globulins protected hogs against inoculation as successfully as does raw serum, but the entire globulin content must be used. Some technical difficulty was experienced in the filtration of the precipitates through filters of the Berkefeld type, but these have been partially overcome. The use of these globulins in field work will be taken up by the State veterinary commission. Evidence has accumulated showing that contagious epithelioma of chickens is due to a group of infections rather than to a single specific one. Vaccines prepared from scab virus are not protective or curative, while treatment with bacterins prepared from cultures isolated from the infected flocks proved very effective.

There are said to be at least five species of biting flies, two of which are especially troublesome to cattle. The breeding habits of four of these species have been worked out. Large numbers of larvæ of one of the species concerned were found in the mud in a slough. These were raised and identified and living material was carried through the winter. As far as these studies have gone they indicate a strong probability that the control of these flies will be largely a matter of drainage. A little work has been done on anthrax serum purification along the line of precipitating the globulin fractions as in hog-cholera serum, this being still in progress.

Due to excessive and late grazing, white sage, the most important forage plant found on winter ranges in the State, is rapidly being killed out. There are now large areas where only dead plants remain of what was once a range of high-carrying capacity. The biological relations of the plant will be studied with a view to securing proper range management to conserve it, the United States Office of Indian Affairs having allotted a tract of white sage land to the station for this purpose. Studies of feeds which may be utilized to supplement the white sage were carried on with very promising results. Feeding cottonseed cake, even in relatively small quantities, as a supplement to the native forage plants proved profitable.

Work with Hatch and other funds.—Anthrax appears to be practically stamped out of the State through the efforts of the station by vaccination. Live-stock growers prefer the serum-vaccine method to the double vaccine, as the former involves handling the cattle only once. It has been conclusively proved that while bacterins do not protect against experimental inoculation of fowl cholera they do protect against natural infection.

Irrigation experiments have led to some quite definite conclusions as to the proper time and amount of irrigation for certain crops. With alfalfa the results indicate that the most economical use of water is obtained where the plats are heavily irrigated after the plants have begun to show a definite need of water by the dark color of the foliage and a slight tendency to wilt. With potatoes where the plants were allowed to wilt badly before irrigation second growth of the tubers resulted with unevenness and a lowered starch content. Heavy irrigation caused increase in scab. The best results were obtained by moderate irrigation as soon as the plants showed a tendency to wilt. With wheat the most critical stage is between the boot and milk stages. Seven-inch applications are more favorable than 3 inches. The tests showed that water can be given sparingly during the formation of the root system.

Variety tests and some breeding work are being carried on with cereals and forage crops. Sixty-five strains of alfalfa are being tested, and considerable work is under way with Sudan grass, which produced 3.79 tons per acre. Bean varieties are also being tested. Oats shatter badly owing to the dry heat of the State. Of the 17 varieties tested Early Mountain shattered least, owing to the fact that the panicles do not blast before the maturity of the plant. Variety tests with barley confirmed the superiority of New Zealand and Blue Ribbon. Improved Leaming was by far the best corn grown for silage. Field peas can not be profitably grown in Nevada except in favorable climatic seasons. The highest yielding potato variety was Great Divide, with Burbank a close second.

The department of range management is studying methods of managing cattle and sheep upon the range to prevent losses from poisonous plants. In the case previously cited, where 1,100 sheep died from eating rabbit brush, it was evident that had the sheep been fed hay before being placed upon the range they would not have eaten this bitter and unpalatable shrub. Similarly sheep, when scattered and feeding leisurely in patches of death camas, ate the grass and weeds in preference and suffered no injury, while another band close-herded and driven passing through a similar area ate the death camas with heavy losses. All observations made thus far indicate clearly that a very large percentage of the losses which occur in Nevada from poisonous plants may be eliminated if intelligent methods of handling stock are employed.

The entomological department did some work on cutworms injurious to alfalfa, but the investigation was terminated by what is believed to be a bacterial disease which appeared to kill off all of the cutworms. The plant louse (*Macrosiphum* sp.) infecting alfalfa was also studied.

A survey of range conditions indicated that there is very little hope of establishing foreign range plants upon Nevada ranges, and efforts should be directed toward so handling sheep and cattle that the native forage of denuded ranges will have an opportunity to reproduce itself. A study is being made of the relative importance of native range forage plants, to get information as to the class of stock to which each range is best adapted, the best seasons for grazing, the carrying capacity of the range, and the system of range management to be used. Economic data have been accumulated of 21 plants. There is little prospect of success from the introduction of foreign plants, but possibilities offer of introductions from other portions of arid America. Data are being accumulated showing the average acreage required to support a sheep for a given time.

In a chemical examination on the relative feeding value of crops of alfalfa, large variations were found in numerous samples of the same crop. The average for the first crop in ash and nitrogen is higher than for the second crop, but lower than the third and fourth crops.

The following publications were received from this station during the year: Bulletins 83, The Value of High-level Meteorological Data in Forecasting Changes in Temperature—A Contribution to the Meteorology of Mount Rose, Nevada; 84, Contagious Epithelioma in Chickens (Chicken Pox—Swelled Head)—Its Control by Vaccination; 85, The Use of Bacterins in the Control of Fowl Cholera; 86, Forage and Root Crops; 87, Home Potato Patches; 88, Field Crops for Late Planting; and the Annual Reports for 1915 and 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15,000.00
United States appropriation, Adams Act-----	15,000.00
State appropriation, including balance from previous year -----	3,962.06
Sales, including balance from previous year-----	2,309.57
Total -----	36,271.63

The Nevada station is handicapped by lack of funds, but is doing work that is showing direct practical results in the State. It is adopting the policy of concentrating its efforts on a few important projects.

NEW HAMPSHIRE.

New Hampshire College Agricultural Experiment Station, *Durham*.

J. C. KENDALL, B. S., *Director*.

The New Hampshire station was called upon to do considerable emergency work in connection with the movements for greater production, utilization, and conservation of foods and feeding stuffs. A farm of 125 acres, costing \$3,000, was secured for the horticultural department, and the bequest of a farm near Portsmouth with money for its maintenance is now under litigation. Some changes in the staff occurred among the assistants without serious interruption to the work.

Adams fund projects.—The project on sheep breeding was actively pursued. Chest caliper measurements and contour work received considerable attention, especially the relation of chest measurements to constitution and fleshing capacity. About 115 fleeces were clipped and studied as to wool character and quality. The short-ear trait in sheep was found to be a simple Mendelian unit factor. A study of ewes' milk showed that for early-market lambs its value lies chiefly in its capacity to promote fattening while the lamb is growing. Milk which will furnish the proper amounts of protein and ash will supply sufficient fat to meet the requirements in growing lambs of suckling age. A study of the effect of the quantitative factor in the milk yield of ewes showed a difference in weight increase of 16 per cent between high-milking and good-milking ewes, 38 per cent between high and fair milkers, and 79 per cent between high and poor milkers. The quantitative supply of proteins and ash which furnish material for direct structural increase is regarded as the limiting factor. The results of breeding experiments still in progress to determine the value of family performance as a basis for selection in sheep seem to favor this method as compared with the selection based on individual traits.

In the horticultural department studies were made on the influence of moisture and temperature on fruit-bud formation. Studies on nitrification in the orchard showed that this proceeded slowly in the

sod plats and that soil moisture was not the limiting factor. On the cultivated plats stirring the soil increased the nitrification, and under a good system of tillage nitrates were usually present in excess of the needs of the trees. The application of lime increased nitrification. Soil temperature observations in the orchard showed the lowest temperature under the heaviest vegetation and the highest under clear culture in the summer, the reverse being true in the winter. Cultivation with cover crops gave a much larger twig growth than sod. The use of a complete fertilizer in addition to cultivation and cover crops produced a marked increase in twig growth after the sixth year of the experiment. Air temperature was more closely related to growth than any other factor. The main growth took place during a period of about 25 days. The growth was apparently more readily affected by external factors during the early part of the growing period.

In plant breeding the squash has been studied as to inheritance of type characters. Some of the extreme characters were found to be inherited. This work is still in progress. Breeding has also been carried on with carnations, using white, pink, and red varieties, selfing and crossing these to note color inheritance.

Investigations have been pursued regarding the effect of fungicides and insecticides on plants. It was found that the cuprammoniums are more toxic when slowly than when quickly dried, and that cuprammonium washes show more toxicity and weather resistance than Bordeaux mixture, when large amounts of soluble copper are required to give protection. The practical applicability of the cuprammoniums is limited and they should not be used in lieu of Bordeaux mixture whenever this yields sufficient soluble copper for protection. The stimulating action of Bordeaux mixture was studied on the tomato. This action appeared to be constant, irrespective of light, temperature, and moisture.

Studies on the toxic action of fungicides on parasitic fungi showed that sulphur was an efficient fungicide for the control of certain rusts under greenhouse conditions, but its value for field application was considered doubtful. Among the results of the work is the control of snapdragon rust by means of sulphur. This has been found to be efficacious against currant rust, the species of which are resistant to copper.

Histological studies of the fruit branches of the apple have been carried on with a view to determine the cause of alternate bearing. In order to produce annual bearing it is necessary to produce the development of the flower buds in about equal numbers every year, and it is believed that this can be accomplished by pruning. The yearly departure from the mean growth must be small in order to obtain regular fruiting.

In the chemical department data have been secured to determine at what time in the life of cereals potash must be applied to produce normal growth and also on the influence of drainage on the root development of corn. It was found that while nitrogen is the limiting factor in New Hampshire soils, phosphorus stands next and is usually low.

Studies on the control of root maggots have yielded results of immediate use in practice. Tobacco dust mixed with other dry substances as diluents, as, for instance, lime, forms a cheap application that is easily handled and gives good results. Carbon dioxid was tried, but did not prove very effective.

Work with Hatch and other funds.—In investigations of the leaf miner of the apple the insect was studied in its various stages, attention being given to the contact insecticides and their effectiveness as increased by their penetration. Little or no penetration was observed on apple leaves and the deeply imbedded miners were not affected. Some work was done on the control of the black fly, which is best done in the fall when the streams are low.

The horticultural department has made a study of the blueberry industry of the State, devising methods of propagation and culture, determining the value of mass selection, and increasing the size of the berry by cross breeding. Experiments conducted with plums included variety and other tests, with considerable data on Japanese plums. Studies were also made of fruits and small fruits in regard to the value of different kinds of cover crops and the effect of lime upon them. A new peach orchard has been established which will be used for variety and fertilizer tests. Experiments on the tomato conducted both in the greenhouse and field included tests on period of growth and maturity, staking the plants or allowing them to spread on the ground, and other related topics.

The agronomy department was called upon to do considerable emergency work in locating and distributing suitable seed potatoes as an aid to greater production. Tests with soy beans showed that some varieties can be profitably grown in the State, and the influence of inoculation on the growth of the plant is being tried. Timothy breeding is in its fifth year and involves about 1,200 plants. Selection was carried on and enough seed secured to plant a half-acre plat. Experiments were also carried on in liming and inoculation tests with beans. Some work on the snapdragons was pursued, special attention being given to the structure and number of stomata and the degree of susceptibility to rust attacks.

The following publications were received from this station during the year: Bulletins 179, Analysis of Fertilizers for 1916; 180, Results of Seed Tests for 1916; Technical Bulletins 10, The Nature of the

Inflorescence and Fruit of *Pyrus malus*; and 11, Notes on the Presence of Nitrates in Orchard Soils.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15,000.00
United States appropriation, Adams Act-----	15,000.00
Sales, including balance from previous year-----	2,414.74
Miscellaneous -----	8,528.37
Total -----	40,943.11

The work of the station stands on a promising footing and increased facilities will afford room for much needed expansion. The special needs of the State are receiving attention. Financial assistance from the State would enable it to still further extend its usefulness.

NEW JERSEY.

New Jersey State Agricultural Experiment Station, *New Brunswick*.

New Jersey Agricultural College Experiment Station, *New Brunswick*.

J. G. LIPMAN, Ph. D., *Director*.

The work of the station was continued throughout the year without material interruption. Some changes occurred in the staff, mostly among the assistants. W. M. Regan was appointed dairy husbandman and H. M. Biekart florist. An appropriation of \$9,000 provides for the construction of a new calf barn, and a new greenhouse has been completed at a cost of \$2,000. State appropriations, much of which was for specific purposes, amounted to over \$98,000. By a law passed in September, 1916, the station is made responsible for carrying out the regulations as to weighing, testing, and purchasing milk and cream.

Adams fund work.—Observations on the availability of nitrogenous fertilizers have been carried on for 20 years, completing four 5-year rotations. The results confirm those previously obtained. Nitrate of soda gave a recovery in the crop of the nitrogen applied of 55.77 per cent, followed by sulphate of ammonia, farm manure, and dried blood, with recoveries of 41.75, 29.85, and 29.41 per cent respectively. In similar experiments in cylinders with soils of varying mechanical composition, nitrate of soda also came out first, with an average nitrogen recovery of 61 per cent. Field and cylinder experiments have been continued, in the study of the accumulation and utilization of nitrogen. Larger yields were obtained in most cases when nitrogen was furnished in the form of green-manure crops, especially with corn, than from either nitrate of soda or stable manure. Soy beans on limed plats had two or three times as many nodules as on the unlimed plats, and both the beans and stalks were richer in nitrogen.

Investigation on the oxidation of sulphur and the conversion of rock phosphate to an available form when composted with it has given interesting results. Laboratory mixtures have been made of rock phosphate and sulphur to determine the rate at which the sulphur is oxidized and the factors affecting it. Iron and aluminum sulphates, especially when used together, hasten oxidation. Nitrates apparently stop the action, possibly due to a change in the biological conditions. Sulphate of ammonia, on the other hand, appears to aid it. Compost heaps were made in the field and subjected to various treatments. In ordinary mixtures 85 per cent of the phosphate was rendered citrate soluble in 30 weeks, but in some selected soils this was accomplished in 12 weeks. It is advisable to inoculate the mixture with soil as this hastens the action materially. A mixture of bacteria and fungi were found in the soils which gave the best results as inoculators, and it is thought that the action may be largely enzymic. Microorganisms seem to start the process and then most of them die. This investigation is being cooperatively engaged in by a number of stations.

The project on the presence, distribution, and constancy of the more common types and species of soil bacteria in soils of different origin was continued, together with the rate of decomposition of organic matter in the soil, which was measured by the amount of carbon dioxid produced and the amount of ammonia accumulated. Particular attention was paid to the spore-forming groups, which are more persistent than the nonspore-forming species. In connection with this work, the effect of fineness of limestone on its influence on ammonifying and nitrifying organisms was studied. Limestone passing a 60-80 mesh was found to be the most effective. The addition of a little nitrate increases bacterial activity in unlocking the materials of the soil and this tends to hasten soil exhaustion. Soluble phosphates also stimulate bacterial and fungi activity to a remarkable degree.

In the department of botany studies have been made of reciprocal crossing, with various vegetables, to determine the best direction commercially for the combinations. A study of environment is being made to determine the relative crop value of seeds produced in the several positions in leguminous fruits, beans, soy beans, peas, and peanuts being used. Results show that there is a marked difference in the viability of seeds and vigor of seedlings, correlated to the amount of abortiveness, between those taken from the base, middle, or tip of the pod.

The toxic effect of excessive amounts of fertilizer salts and the ill effects of poorly balanced combinations of fertilizers are subjects of study in the greenhouse.

Work with Hatch and other funds.—Cooperative experiments on spraying potatoes are in progress against the blight to determine if this is a paying practice. It was found that tubers infected with leaf curl and mosaic disease gave a yield below normal. This was true to a less extent with tubers infected with *Rhizoctonia*. Spraying for the control of foliage diseases of the tomato, in cooperation with the Office of Cotton, Truck, and Forage Crop Disease Investigations, United States Department of Agriculture, using a modification of Bordeaux mixture, has given very encouraging results. The organisms causing root diseases of celery were determined. Other work of the department included a study of peach yellows and of the fungi injurious to paints.

The entomological department has carried on investigations on the house fly, especially in regard to its response to certain foods. Ammonia was found to be the chief constituent of manure that attracts flies. The treatment of breeding places and the use of poisoned bait resulted in considerable mitigation of the nuisance. It has been determined that the life of the bean weevil is dependent on atmospheric humidity. A high moisture content encourages the growth of fungi which will destroy both the bean and the weevil. The most favorable condition is about 75 per cent of moisture. With a moisture content of 26 per cent or below, all reproduction ceases. Thus any means that will preserve a dry atmosphere in storage, as lime, will prevent injury. Seed corn may be protected from the attacks of the grain moth in the same way.

An apparatus by which the concentration of hydrocyanic-acid gas in greenhouse fumigation may be controlled was devised, and the distribution of the gas studied. The maximum concentration is reached in about eight minutes. Different greenhouses exhibit peculiarities of distribution, sometimes giving a sufficiently high concentration at some points to kill the plants and at others not sufficiently so to kill the insects. Multiplication of the points of gas discharge tends to correct this. The tightness of glazing also plays an important part. Carbon disulphid is practical for the control of the mushroom spring tail.

Experiments on the control of orchard aphids have shown that about 95 per cent are destroyed by coating them with winter strength lime-sulphur and about 98 per cent are killed when wetted with a 2 per cent solution of crude carbolic acid to which enough soap has been added to break the surface tension. The efficiency of the lime-sulphur is increased by the addition of 40 per cent nicotin at the rate of 1:500. A thorough spraying of apple trees with this mixture is recommended just as the leaves begin to develop. The same treatment is recommended for the control of the pear psylla, applied just before the blossoms open, but the treatment must be very thorough.

No satisfactory results have been obtained as yet in the control of the peach borer by spraying.

Various devices for applying the sulphur arsenate of lead dust for the control of the strawberry weevil have been tested. A small screen-wire sifter, covered with wire cloth, is the best for small areas but for large acreages an engine-driven dusting machine is better. With such a machine about 25 acres can be treated in a day. Corn dusting experiments were made with equal amounts of arsenate of lead and dry sulphur, which proved effective against the earworm. In laboratory experiments it was found that sodium cyanid applied to the soil at the rate of 100 pounds to the acre destroyed 100 per cent of a wireworm infestation, but the same material applied to the soil under natural conditions had no effect on worms of the same species. Such heavy applications were necessary that the cost rendered its use impracticable.

The station has taken an active part in mosquito control, the work being done under State funds. Oyster propagation studies are also carried on at the station under special State appropriations.

The horticultural department has for a number of years been carrying on peach pruning experiments at the Vineland orchard. The plats which were summer pruned gave ample demonstration that this delays the maturing of the fruit. Results have shown that, contrary to the general belief that summer pruning checks wood growth, it encourages it. Extensive spraying and dusting experiments have been carried on in the orchard; also methods of gathering, packing, and shipping. Greenhouse experiments have included plant-breeding studies with carnations, and a number of seedlings are now producing purple flowers of value. Peach-breeding experiments promise several valuable new types.

Investigations in the department of poultry husbandry have been made along various lines. Breeding problems dealing with the inheritance of fecundity have given some interesting results and some exceptional strains of birds have been developed. Studies on the inheritance of color patterns and pigmentation in hybrids are giving results. Reciprocal crossing of Black Hamburgs and White Leghorns have been made and birds in the F_3 generation are now at hand for study. The inheritance of eggshell color has received attention, especially the variations in the color of the eggs laid by individual hens during the season. Observations are also being made on the sequence of sex in chicks hatched from eggs laid by individual hens to find, if possible, some definite relation between certain measurable factors and sex. Studies on the amount and cause of embryo mortality have shown a great difference in the hatchability of eggs from individual hens, which leads to the belief that poor hatches are usually due to the quality of the eggs rather than faulty incubation.

The causes that contribute to the hatchability of eggs include breed, age, season, productivity, vigor, vitality, and individuality. Feeding experiments are being made to determine which of the so-called protein carriers, as milk products and vegetable concentrates, can be safely fed or substituted in whole or in part for meat scrap.

Other poultry work includes the relation of time of hatching to molting, the standardization of poultry houses and equipment, the home preservation of eggs, types, and breeds as affecting economic capon production, season as a factor in broiler production, and a survey of the poultry diseases in the State.

Experiments are being carried on on methods and cost of pork production, including the value of black-strap molasses in the ration of brood sows, the use of the self-feeder, the cost and time necessary to reach a 200-pound weight, and forage crop mixtures for summer pastures.

Studies carried on in the dairy department included the comparative value of wet and dry brewers' grain, an economical ration for wintering dairy heifers, the relation of the conformation of dairy heifers to their future production, and the comparative value of eastern and western alfalfa hay as a feed for dairy cows.

Various lines of work have been carried on by the agronomy department, including tests of varieties of wheat, the sources of alfalfa seed, time of seeding alfalfa, and the rate of seeding and value of nurse crops. Fertilizer experiments with corn were made, with differing amounts of nitrate of soda and on the effects of different amounts of potash.

The following publications were received from this station during the year: Bulletins 291, The Influence of the Tannin Content of the Host Plant on *Endothia parasitica* and Related Species; 292, The Response of the House Fly (*Musca domestica*) to Ammonia and Other Substances; 294, Farm Profits and Factors Influencing Farm Profits on 370 Potato Farms in Monmouth County, New Jersey; 295, Commercial Feeding Stuffs and Registrations for 1916; 296, The More Important Greenhouse Insects; 297, Analyses of Commercial Fertilizers, Fertilizer Supplies, and Home Mixtures; 298, Report of the Director for 1916; 299, The Influence of Salinity on the Development of Certain Species of Mosquito Larvæ and Its Bearing on the Problem of the Distribution of Species; 300, A Biological Study of the More Important of the Fish Enemies of the Salt-marsh Mosquitoes; 301, Analyses of Materials Sold as Insecticides and Fungicides for 1916; 302, Results of Seed Inspection, 1915 and 1916; 303, Analyses of Commercial Fertilizers and Ground Bone; Analyses of Agricultural Lime; 304, Fertilizer Registrations for 1917; 305, Maintaining the Nitrogen Supply of the Soil—Continuous Wheat and Rye with and without a Leguminous Green-manure Crop; Circulars 59, The

New Jersey Seed Law; 60, Weed Control; 61, The Agricultural Value of Greensand Marl; 62, Digest and Copy of Law Regulating the Weighing, Testing, and Purchasing of Milk and Cream; 63, A Substitute for Self-boiled Lime-sulphur and Other Summer Sprays for Peaches; 64, A Press for the Georgia Carrier; 65, The 1916 Tests of Sulphur-arsenical Dusts Against the Strawberry Weevil; 69, Corn; 70, Field Bean Production; Hints to Poultrymen, volume 5, No. 1, Preparing Birds for Exhibition; 2, The Vineland International Egg Laying and Breeding Contest; 3, The Value of Post-mortem Examinations; 4, Mating and Early Hatching; 5, Our State Department of Poultry Husbandry, Its Organization and Activities; 6, Colony Brooding; 7, Chick Troubles; 8, The Capon; 9, The Poultryman's Problems in 1917; and Annual Report, 1915.

The income of the station during the past fiscal year was as follows:

State station:	
State appropriation-----	\$98,400.00
Fees-----	42,403.40
Sales-----	26,802.19
College station:	
United States appropriation, Hatch Act-----	15,000.00
United States appropriation, Adams Act-----	15,000.00
Total-----	197,605.59

The New Jersey stations are applying their work actively to the problems of the State and are extending their experiments and influence into different sections as occasion arises. The liberal State appropriation gives the experimental work a strong position.

NEW MEXICO.

Agricultural Experiment Station of New Mexico, State College.

FABIAN GARCIA, M. S. A., *Director.*

During the year the station came under an entirely new board of control and a new president, but the work has not been seriously interrupted. War work was very active during the spring. The director has taken a leading part in the State, assisting in getting out some important publications and providing seed for farmers. The legislature appropriated \$7,500 a year for the next two years. Legal complications which have tied up some of the funds have been decided in favor of the institution, which will give several thousand dollars more for station use.

No additions to the building equipment were made and but few changes in the staff. F. W. Christensen, in charge of the nutrition investigations, resigned to go to the North Dakota college and was succeeded by J. D. Hungerford.

Adams fund projects.—An important line of work of direct practical application in the State is being done on the leaching of alkali soils. Results have shown that the alkali may be leached out and the soil improved by irrigation, but that excessive irrigation tends to leach out the plant food also.

The study of the organism causing the chili blight points toward a fusarium which is uniformly present in infected plants and in the soil, but inoculation experiments with it have been only partially successful.

The project on the relation of soil water and crop in respect to irrigation was continued for the third year. Six cuttings of alfalfa were harvested during the season. The plats which received the least amount of water at an irrigation but which received most irrigations per season gave the highest duty. On the fallowed plats the moisture goes down much more rapidly than on the cropped plats. With the lighter irrigation the root penetration is less than with heavy irrigation.

Codling-moth life-history investigations show that there is considerable variation in different years. As a rule, there are four full broods and a partial fifth. Spraying is necessary to control the moth but is effective. Arsenate of lead in powdered form is used. Three sprayings are used on pear trees and five on apples. In some unsprayed pear orchards 85 per cent of the fruit was wormy, but spraying gave from 94 to 99 per cent of sound fruit.

Work on improvement of the native chili has been very satisfactory. Blight resistance has been developed. It is recommended that planting be done in a furrow, gradually ridging up so that the roots are deep. Variety No. 9 proved to be one of the best, yielding 2,676 pounds of dried chili from about an acre.

Irish potato studies show that it is necessary to have moisture in the soil before the potatoes are planted in order to get good yields, which can be done to best advantage under irrigation. With a total winter irrigation of 10 inches the yield was nearly 7,000 pounds per acre, with very few small potatoes and no diseased ones among them. Irish Cobbler was the variety used. There are some indications that the late planting will give the best results, allowing the plants to grow in the hot weather and the tubers to form when the cool weather comes.

Work with Hatch and other funds.—Tests of sugar beets show that a good quality can be grown in some parts of the State. The maximum sugar content found was 20.3 per cent, the maximum purity 94 per cent. The average was about 13 per cent sugar and 79 per cent purity. Seeding during the last half of April gave the best results.

A trial of the effectiveness of different sprays against the San Jose scale showed that many of them can be applied later in the season than was formerly supposed without injury to the foliage or flower buds. Analysis of the soil about chlorotic trees showed a deficiency of humus, lime, magnesia, and iron. Spraying with iron sulphate corrected the chlorosis temporarily, but it returned. A study was made of root rot, especially of alfalfa and the apple. Its effect is to make the plant shallow rooted by destroying the tap root. A plant-disease survey in cooperation with the United States Department of Agriculture has resulted in a list of 54 diseases, 23 of which were reported for the first time in the State.

A large amount of preliminary work has been accomplished in a study of the ground waters of the Rio Grande Valley. The work promises to be of the greatest importance, the farm practice being dependent on this knowledge, and the area is to be extended. Some interesting points on the behavior of the ground water table were brought out by this investigation in the Socorro Valley, the water table receding rapidly, beginning in the spring, while in the Mesilla Valley the water table rose rapidly, commencing with the spring months.

The horticultural department has carried on extensive variety tests with apples in determining the best ones for local use. Smudging was tried when the temperature indicated it. With 200 pots on 2 acres of peach trees the temperature was raised from 2° to 6.5° F. Apple grafts on pear trees made a good growth and bore a good crop of apples. In a number of cases the apple graft was larger than the pear stock below. Attempts to introduce varieties of beans from other States were not successful, evidently on account of the heat and dry weather. Japanese plums did well. Most of the varieties of strawberries, blackberries, and raspberries succumbed to the extreme heat and low humidity of the summer. Walnuts and pecans showed considerable difference in hardiness, some varieties apparently standing the conditions while others were killed out.

Experiments on trellising *Vinifera* grapes showed that this species is not well adapted to training on trellises. Variety tests of cereals in pure lines and of saccharin and nonsaccharin sorghums have been quite successful. Trials of methods of irrigating corn showed that planting in a dry soil and irrigating afterward gave a better yield and were at least a week earlier than planting in a moist soil and delaying irrigation until after the plants had germinated. Trials with cotton show that it can be successfully produced in some of the irrigated valleys of the State. Burnett and Durango yielded, respectively, 1.47 and 1.46 bales of lint cotton to the acre.

Experiments in pasturing dairy cattle on Sudan grass, which does well on irrigated lands, showed this to be one of the best annuals for

pasture during the summer and fall. It is of good quality, makes a quick growth after being pastured off, and responds promptly to irrigation. It is closely related to and much resembles Johnson grass, but not having the root stock of the latter it is not so difficult to eradicate. In composition and digestibility for both pasture and hay Sudan grass is about the same as Johnson grass or timothy. The place of Sudan grass is to supplement the permanent pastures during the summer. It does not form a turf, however, and some of the plants are pulled up by the roots at the first grazing. It should not be pastured until it is 15 to 18 inches high.

Russian thistle grows abundantly as a weed and the young plants are eaten by stock. A trial was made to see if it would produce a good silage. The silage had a dark brown color and strong acid odor, which soon became unpleasant on exposure to the air. Heifers fed with this material for 10 days lost weight, so that it is not to be recommended.

To determine the value of tankage as a substitute for corn in fattening hogs three lots were fed, one with corn alone, one with corn and standard tankage, and one with corn and a local product called El Paso tankage. At the end of the experiment the first lot made a profit of \$62.10, the second \$133.29, and the third \$127.02. The cost of 100 pounds of gain in the first lot was \$11.34, in the second \$8.76, and in the third \$8.56.

The mesquite bean which grows wild over large areas of the otherwise barren mesas of the Southwest contains, including the entire pod, the following amounts of digestible nutrients in 100 pounds: Crude protein, 8.34 pounds; carbohydrates, 54.02 pounds; and fat, 2.4 pounds. This gives it a feeding value comparable with barley. It is readily eaten by stock. Experiments in feeding the ground pods to pigs showed that it approaches the grains very closely in nutritive value. With grains worth \$1.50 per hundredweight, mesquite beans proved to be worth about 80 cents. The results show that the beans are an economical food when the grains are high.

Comparative steer-feeding experiments carried on in cooperation with the Bureau of Plant Industry for the purpose of determining to what extent dry farm crops may be used in feeding range steers for the local markets led to the conclusion that all the feeds necessary for fattening range steers for beef on a properly balanced ration may be grown under dry-farming conditions, and the feeding may be more economically done by using cowpea hay instead of cottonseed meal or cake. The total gain of the cowpea-hay lots was 35 per cent greater than the cottonseed-meal lots. The average cost per 100 pounds of gain for the former was \$4.98; for the latter \$6.65. The results strongly emphasize the superior value of cowpea hay as a roughage in fattening steers.

Experiments in feeding lambs to determine to what extent they will clear fields of weeds during the fall season and if corn silage may be substituted for the usual grain-and-alfalfa ration were tried. One hundred and sixty-eight lambs were turned into the fields with corn-stalks and weeds, with a small allowance of shelled corn. They were then put in the feeding pens for finishing off. They finally sold with a net profit of \$534.94, showing the advantage of having a few sheep to eat up the roughage and waste. Results in poultry feeding showed that cottonseed meal can replace meat meal to advantage to a considerable extent.

The following publications were received from this station during the year: Bulletins 101, Feeding Range Steers; 102, Grasshopper Control; 103, The Utilization of Feed by Range Steers of Different Ages—II, Alfalfa Hay and Milo Maize Meal; 104, Dry Farming in Eastern New Mexico; 105, New Mexico Beans; 106, The Bean Beetle (*Epilachna corrupta*); and the Annual Report for 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15,000.00
United States appropriation, Adams Act-----	15,000.00
State appropriation, including balance from previous year -----	6,715.34
Individuals-----	125.00
Farm products, including balance from previous year--	14,523.13
Total -----	51,363.47

The New Mexico station has prosecuted its work actively and efficiently and addressed itself to many of the leading problems of the State. Its success in securing an appropriation of \$7,500 a year from the legislature shows the appreciation in which it is held.

NEW YORK.

Cornell University Agricultural Experiment Station, Ithaca.

A. R. MANN, B. S. A., A. M., *Director*.

The station has entered actively into the emergency work undertaken in the State. The director was appointed commissioner in charge of the food conservation division organized at the station, which did valuable work in the prevention of losses at the point of production.

The station staff was reduced by a number entering the Army or emergency work. C. B. Hutchison was added to the department of plant breeding and M. E. Farnham was appointed in the division of floriculture.

A new room was added to the forestry building in which a portable sawmill is installed. A sheep barn was built and additions were made to the greenhouse facilities.

Although the State makes no definite appropriations for the station, a considerable amount of investigation is carried on through graduate students, employing funds appropriated by the State to the college of agriculture. A special appropriation was made of \$8,000 for investigations in bean production in the State.

Adams fund projects.—Investigations in soil technology showed that there was a much greater loss of lime from bare than from cropped soils. Calcium, magnesium, and nitrogen appear to be conserved by growing crops, while the reverse is true of potassium. Determinations of carbon dioxid in cropped and uncropped soils in lysimeters indicate that this increases in the cropped soils up to the time the plant reaches full bloom, when it begins to decrease. A series of experiments with plants grown under sterile conditions showed that reduction and oxidation of nitrogen compounds go on concurrently.

Plants exert an inhibitive or a stimulating effect on nitrate formation. Corn was found to have a strong stimulating effect. The accelerated reduction of nitrates caused by plants is probably due in part to enzymotic action, but it appears that there is some other agent that does not succumb to the usual methods of destroying enzymes. Analysis of the drainage waters from unplanted and planted lysimeters shows more nitrogen in the unplanted tanks than in the crops and drainage water combined in the planted tanks, indicating the disappearance of available nitrogen in cropped soils.

Most of the plant-breeding work under the Adams fund is centered around the laws of inheritance in hybridization, several phases of the subject being under investigation. Some of this is done in cooperation with the United States Department of Agriculture and other institutions. New varieties are distributed to farmers over the State, which gives opportunity to note the growth and behavior in different environments. Small grain breeding has been carried on with special reference to the Mendelian behavior of characters in wheat, oats, barley, and corn. Phlox, morning-glory, and flax have also been used for this purpose. Work with corn has resulted in the isolation of over 30 distinct Mendelian factors. A few linkages have been discovered and independent inheritance has been proved in several cases.

Considerable work has been done in crossing oats. Results derived from crossing awned and awnless types show that the awnless type is almost completely dominant in the first generation and that the second generation gives awnless, partially awned, and fully awned plants in a ratio that approximates 1:2:1.

In the study of mutations, selection has been continued as in previous years with pure lines of wheat, oats, beans, and potatoes to discover any possible cumulative effect of long-continued selection.

Further studies of bud variations in potatoes have been made. Thirty to forty variations in types have been found in the oxeye daisy, some of these being heritable and coming true to seed. Similar studies have been pursued with phlox and morning-glory.

Another phase of the work has been on the influence of environment in producing variations and mutations. Pure lines of wheat have been grown on artificial soils of diverse fertility and also under field conditions in different parts of the United States. The results of seven years of observations have failed to show any cumulative effect. Studies of the variegated pericarp of maize indicate that a genetical factor for variegation mutates to a factor for self-color and that only one of the duplex factors ordinarily so mutates. The simple form of inheritance of 30 factors has been worked out and their linkages are being studied. From single tuber lines of potatoes different types have been isolated. From the same hill tubers showing bud variation were found, the buds being tinted or white, and in one case a bud partly bluish and partly white was found. An investigation of correlation of potatoes to determine the relation between size of seed, habits of plants, yield, and other factors was conducted.

Work with Hatch and other funds.—Various studies have been carried on by the dairy department, especially in problems of sanitary milk production and distribution. In cooperation with the Bureau of Markets, United States Department of Agriculture, the department has investigated the function, organization, operation, construction, and equipment of country milk stations. Studies on the clarification of milk showed that the average increase in bacterial count by the use of this process was 87.15 per cent in fresh milk and 114.77 per cent in old milk. This increase is apparently due to the breaking up of the colonies and not to any actual increase in the number of bacteria. Bacteria were found to increase more rapidly in unclarified than in clarified milk. The volume of cream separated by gravity is reduced from 2 to 3 per cent by clarification, showing a more complete emulsification, as the fat content remains practically the same. The process removes 99 per cent of the insoluble dirt.

Investigations of the scars and deformities of apples caused by insects, it is hoped, will aid the orchardist to recognize the insects causing these obscure injuries and to thus be able to deal more intelligently in their control.

The leaf bugs of the family Capsidæ and the family Lygus are becoming more injurious to the orchardist, gardener, and general farmer every year. To the family Lygus belong the apple red bug and the tarnished plant bugs. Their habits, life histories, and food plants are being worked up. The poplar and willow borer, a recently

introduced European pest, was found to be effectively controlled by treating trees above the roots 4 to 5 feet high with a coal-tar product when the trees are dormant and after pruning. This can be done at a cost of 1 cent for five trees. The life history and control of apple aphids has been studied. The principal emergency work of the year was the study of the cherry fruit fly which appeared suddenly in western New York. An extended investigation of the pests attacking beans is being carried out on funds appropriated for that purpose by the State. This includes the life history, habits, and control of snails injuring beans. The seed-corn maggot proved to be a serious pest on the bean.

Studies on the distribution of egg production show that a hen may lay well for at least eight years. Records which have been kept of the dates a pullet lays her first and last egg in the first laying year are valuable in determining her laying capacity. It was found that there is a close relation between external measurements, the appearance of the fowl, and her egg production. This relation is so close that it is possible to tell not only whether a hen is laying or not but how heavily she is laying, and during the summer and fall to tell quite accurately the number of eggs she has laid the past year. The results of six years of breeding have shown that the size, shape, and color of eggs are heritable characters and may be controlled by selection. The number and quality of the offspring depend more on the degree of breeding of the pullets, production of the mother, and environment of the parents than upon the apparent vitality of the parents as indicated by external characters.

A study has also been made of the relationship between the primary and secondary sexual characters and the male's behavior as indicating breeding value. The principles of poultry-house construction are being studied by means of a large model under positive control as to temperature, humidity, composition of the air, and ventilation. The effect and cost of electric light on egg production are under observation.

Studies in farm management have included studies of the types of farming in various sections of the State and the natural economic factors that make these types best for the region, cost accounting, the cost of potato production, and the use of small tracts of land for homes for persons employed in cities and towns.

A study of the nitrogen balance of the soil under timothy and alfalfa so far indicates a slightly greater gain of nitrogen under alfalfa. The experiment is to be continued for five years. Investigations on the liming of soils have shown better results with burnt lime than with ground limestone.

From a comparison of grazing and mowing conditions on the life of various grasses, blue grass did not decline under grazing condi-

tions, but timothy, redtop, and the rye grasses showed some deterioration. An important line of work being carried on is the classification of varieties, as much confusion exists in the nomenclature. This is being done at present with oats, barley, and peas.

Several improved strains of oats, wheat, timothy, and potatoes have been developed and turned over to the extension division for distribution.

A large amount of research work has been conducted in the field of plant physiology along various lines. The cambial activity is found to vary in different plants. In the grape it begins between May 23 and 29 and ceases before August 9. In the peach it begins at the time of the opening of the buds and appears to be in a resting condition by July 19. A study was made of the efficiency of different strains of *Bacillus radicicola* in the production of nodules and the fixation of nitrogen when transferred from true hosts to secondary ones. The organisms of peas transformed to the vetch produced nodules, but without the fixation of nitrogen. Physiological studies of the organism of the soy bean showed that the effect of nitrates in depressing nodule formation is only local in character and the plant does not exercise any preference of methods for obtaining nitrogen. Work on the physiological rôle of the various sugars in plants included the toxicity of galactose and mannose for green plants and the antagonistic action of other sugars toward these, the rôle of glucose and fructose, and the utilization of the pentoses by the plant.

In floriculture a great deal of work has been accomplished in collecting, identifying, and describing the large number of varieties, especially of roses, peonies, phlox, iris, sweet peas, and gladioli.

Experiments on the treatment of fence posts include treatment by brushing, dipping, and the open tank. By the latter method, which gives by far the most absorption, different kinds of wood show a large variation. Hemlock gave an average absorption of 0.774 pound of creosote per cubic foot, with an average cost per post of 2.7 cents, while the average absorption of the hard woods was 5.235 pounds of creosote at an average cost of 10.3 cents per post. Eleven demonstration areas of typical forest lands are maintained over the State in order that the work of improvement may be observed by the farmers.

Studies in plant pathology showed that a dust mixture of 90 parts of fine sulphur and 10 parts of equally fine arsenate of lead controlled leaf diseases of the horse-chestnut, currant, plum, cherry, quince, and rose in the nursery. Work in this department has also included studies of the mosaic disease of the bean, with special reference to its transmission and attempts to breed resistant varieties. It was found that the bean anthracnose splits into strains which vary as

to their infective properties with reference to different plants. For the control of crown canker of roses soil sterilization is recommended and care in using only healthy stock and scions for grafting.

Home-garden trials were made to determine as accurately as possible the returns which might be secured from various sized plats. Records were kept covering all costs of seed, land rental, fertilizer, and labor against returns from produce harvested charged at market price. A plat of 30 by 10 feet gave gross returns of \$2.47, one 30 by 40 feet gave \$15.56, and one 50 by 30 feet \$16.41.

The following publications were received from this station during the year: Bulletins 377, Cost Accounts on Some New York Farms; 378, The Lesser Migratory Locust; 379, Black Rot, Leaf Spot, and Canker of Pomaceous Fruits; 380, The Hard Rot Disease of Gladiolus; 381, Leaf Smut of Timothy; 382, Sun-scald of Fruit Trees, a Type of Winter Injury; 383, The Pine Bark Beetle (*Ips pini*); 384, Some Effects of Oxygen and Carbon Dioxid on Nitrification and Ammonification in Soils; 385, Dusting and Spraying Nursery Stock; 386, Physiological Studies of *Bacillus radicum* of Soy Bean (*Glycine max*) and of Factors Influencing Nodule Production; 387, Studies on Clubroot of Cruciferous Plants; 388, The Poplar and Willow Borer; 389, Clarification of Milk; Memoirs 9, Influence of Certain Carbohydrates on Green Plants; 10, A Classification of the Varieties of Cultivated Oats; and the Annual Report for 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$13, 500. 00
United States appropriation, Adams Act-----	13, 500. 00
Total-----	27, 000. 00

The New York Cornell station continued its research activity along numerous important lines, and centered its efforts particularly in the solution of problems especially vital at this time, bearing directly and indirectly upon food production and other needs of the State and Nation.

New York Agricultural Experiment Station, Geneva.

W. H. JORDAN, D. Sc., LL. D., *Director*.

The New York State station was called upon to do its full share in emergency work and many of its staff were thus engaged. The time of the director was much taken up with work on the Federal Milk Commission and as advisor on food conservation. R. J. Anderson, the associate chemist, was called to the War Department for work on nutrition problems in connection with the Army. There has been hardly a department of the station that has not entered directly or indirectly into this kind of work. The vice director was also called away from the institution. J. F. Barker, the agronomist, resigned during the year.

The new \$100,000 administration building is nearing completion and is expected to be ready for occupancy during the coming year. A respiration apparatus to be used with small animals was received and set up. No increase of funds was received for the year.

Adams fund projects.—The work under this fund has been largely along the line of dairy bacteriology and milk sanitation in cooperation with the New York Cornell and Illinois stations. Much work has been done in perfecting methods for the bacterial count in milk examination. The microscopic method appears to be much more accurate than the plate method of counting. The latter shows clumps or groups of bacteria, and what is referred to as so many per cubic centimeter is in reality so many colonies per cubic centimeter, the number of individual bacteria being much greater. It was found that the number of bacteria in market milk is rarely less than twice the number of colonies developing on agar plates, even after prolonged incubation, and that the number is usually from three to six times the number of colonies. Largely as a result of this work New York City now requires a bacterial count for the grading of milk. The studies in milk sanitation have been largely confined to tests made of milking machines as a source of bacterial contamination and the importance of the udder as a source of bacteria. Data indicate that infected udders occasionally supply large numbers of bacteria to milk.

In connection with cheese investigations which have been in progress for a number of years, a method for the preparation of pure casein has been devised. The product is found to have quite different properties from casein as ordinarily prepared, which contains calcium phosphate and caseinate and probably other impurities. Pure casein was obtained by slowly adding acid to skim milk with constant agitation and allowing it to stand a few hours. The product is then purified by washing with water and alcohol and centrifuging. The material so obtained is a fine, light, white powder that forms a clear solution in alkali.

A method has been devised for studying the action of lactic acid in milk by titration with lactic and hydrochloric acids and determining the hydrogen-ion concentration. The amount of free lactic acid in sour milk can be accurately determined by means of the hydrogen-ion concentration. The results in a general way show that when milk sours ordinarily a small amount of free lactic acid begins to appear in about 20 hours, when the total acidity as shown by titration is equal to about 37 cubic centimeters of tenth-normal acid per 100 cubic centimeters of milk. This increases gradually and at the end of 48 hours reaches a maximum of over 2 cubic centimeters of tenth-normal lactic acid, when the total acidity shown by titration is over 100 cubic centimeters of tenth-normal acid in 100 cubic centimeters

of milk. This shows that it is very inaccurate to ascribe the acidity of milk as being due to the presence of free lactic acid as such.

Work with Hatch and other funds.—A series of experiments with nine soils from different parts of the State to determine the relation of the various methods of chemical examination to crop-producing capacity, showed that laboratory methods, as far as devised, failed to measure the fertility of the soil. Soil requirements as to calcium, sulphur, and other constituents have been continued on field plats that have been under observation for 25 years. The value of these long-continued experiments is evident, as it eliminates annual and temporary fluctuations in climatic and other conditions. Much of the experimental work on soils is carried on in lysimeters to check the field results. A study of the varieties and strains of alfalfa in regard to growth and seed production has been carried out and seed has been successfully produced. A method was devised by the department for determining carbonates in limestone on the principle of the hydrometer that requires no weighing.

Poultry-feeding experiments relative to the importance of the coarser vegetable foods and the utilization of farm waste have been continued; also the importance of certain mineral nutrients.

Studies on the soil flora have been actively pursued. The direct microscopic examination, similar to the method proposed and used in milk examination, has been used with soils. Because of the difficulty in making soil preparations in which the bacteria can be seen, entirely new staining methods were successfully worked out. The method does not give as satisfactory counts as it does in milk, but it has proved very useful in noting what microorganisms are actually present in the soil in active condition. It has been shown in the course of this work that the nonspore-forming bacteria, mostly motile rods, are the most abundant and presumably the most important, contrary to what has ordinarily been believed. The next most abundant type was found to be the actinomycetes. The spore-forming bacteria appeared only in comparatively small numbers. One of the general conclusions drawn from this series of investigations is the necessity of extreme caution in establishing a causal relation between any kind of microorganism and any chemical transformation in the soil. Certain actinomycetes occur in soils that resemble the potato-scab organisms, and they are being studied to learn if they are actually the same. Work has also been begun upon the organisms in the soil known as ammonifiers to determine which of them actually carry on the ammonification.

It was found that witches' broom of hickory trees was probably caused by the fungus *Microstroma juglandis*, never before so reported. From observations of degenerate strains of potatoes it is concluded that leaf roll, curly dwarf, and mosaic are closely related dis-

orders due to the same general undertermined cause, and that spindling sprout is not related to them. Normal foliage proved to be no guaranty of productivity, as degeneration at times occurs quite suddenly. It is regarded as unsafe to select seed potatoes from a field with any degenerate plants, as even normal plants from such fields may produce worthless progeny. The study of black heart in potatoes indicates that for normal sprouting about 19 volumes of air per volume of tubers are required, black heart being liable to appear when it falls below this. The injury appears to be due to lack of oxygen rather than an accumulation of carbon dioxid. Insufficient aeration during storage was not found to cause spindling sprout.

Neck-rot disease of onions was found to be caused by *Botrytis allii*. Infection of the bulbs in the fields was found to take place through the leaves and neck, the rot occurring either in the field or in the storage house. Seed heads may become infected by wind-blown spores, causing blasting of the flowers. Encouraging results in its control were obtained by soaking the seed for 20 to 30 minutes in formalin solution, 1 ounce to 2 or 3 gallons of water, and spraying the crop with a 5:5:50 Bordeaux mixture early in July and making 3 or 4 applications during the growing period.

Blister canker of apple trees proved to be caused by *Nummularia discreta*, the fungus being most liable to attack trees that are in a slow growing or weakened condition as a result of drought or other causes. It is best controlled by proper orchard management with a view to keeping up a vigorous growth.

The control of apple aphids whose life history and habits were worked out, was found to be effective by spraying with lime-sulphur and nicotin sulphate. Special attention was given to fruit deformities to determine the insects which cause them, including insect depredations after packing and in cold storage. The life history and habits of a species of pear thrips and the pear sinuate borer are being investigated to ascertain means for their control. Other injurious insects studied during the year were the orchard ermine moth, the peach leaf weevil, the lesser peach borer, the linden cankerworm, the gooseberry fruit worm, and the green fruit worm of apples. Nearly all of these pests were found to be controlled by ordinary spraying methods with arsenate of lead or Paris green, except the borers which should be dug out. The leaf weevil was found to be attacked by a braconid which, however, is not present in sufficient numbers to check the pest. Early planting was found to be the simplest and most effective means of preventing damage by the radish maggot. For production of plantings during the period of prevalence of the insects, growing them under screening is advised.

The station maintains probably the largest variety collection of fruits in the country, if not in the world, every new variety being

added as it appears in order to secure material for the fruit monographs which form a distinctive feature of the station's work. Much breeding work with fruit is carried on, over 20,000 seedlings now being under observation. Different methods of pruning and tests of the various varieties for grafting stock are carried out. Fertilizer and cultural experiments with grapes are in progress looking toward the successful growing of the European grape, *Vitis vinifera*. It was found advisable to graft the European grape on Phylloxera-resistant roots and to protect the vines by bending them to the ground and covering with a few inches of dirt. Proper drainage reduced the winter injury to grapes and culture and fertilization should be practiced with a view to assuring proper maturity of wood by the close of the season. Experiments in the culture of the globe artichoke showed that it was good practice to cover the plants with coal ashes during the winter. It was found that marked variation existed in the producing capacity of individual plants and, consequently, the use of offshoots from the old main root of the plant was the most reliable method of propagation.

The publications received from this station during the year were as follows: Bulletins 415 (with popular edition), Plant Lice Injurious to Apple Orchards—I, Studies on Control of Newly-hatched Aphids; 416 (with summary), Seed Tests Made at the Station During 1915—I, Inspection of Agricultural Seeds; II, Voluntary Examinations for Correspondents; 417 (with popular edition), Some Notes on the Breeding of Raspberries; 418 (with popular edition), Culture and Forcing of Witloof Chicory; 419 (with popular edition), The Cabbage Maggot—Its Biology and Control; 420, Inspection of Feeding Stuffs; 421 (with summary), Lime-Sulphur *v.* Bordeaux Mixture as a Spray for Potatoes, IV; 422 (with popular edition), Observations on Some Degenerate Strains of Potatoes; 423 (with popular edition), Miscellaneous Notes on Injurious Insects; 424, Measurements of Soil Fertility; 425, Report of Analyses of Samples of Commercial Fertilizers Collected by the Commissioner of Agriculture during 1916; 426, Cork, Drouth Spot, and Related Diseases of the Apple; 427, New or Noteworthy Fruits, V; 428, Director's Report for 1916; 429 (with popular edition), Goat's Milk for Infant Feeding; 430, Ground Limestone for Use in New York State; 431, Plant Lice Injurious to Apple Orchards—II, Studies on Control of Newly-hatched Aphids; 432, Vinifera Grapes in New York; 433, Winter Injury of Grapes; Technical Bulletins 54, Concerning the Utilization of Inosite in the Animal Organism—I, Concerning the Effect of Inosite upon the Respiratory Exchange in the Dog; II, The Effect of Inosite upon the Metabolism of Man; 55, Concerning Certain Aromatic Constituents of Urine—A Study of the Non-phenolic Volatile Oils Isolated from the Urine of Cows,

Goats, Horses, and Human Beings; 56, The Leaf Weevil (*Polydrusus impressifrons*); 57, Soil Flora Studies—I, The General Characteristics of the Microscopic Flora of Soil; II, Methods Best Adapted to the Study of the Soil Flora—58, Soil Flora Studies—III, Spore-forming Bacteria in Soil; 59, Soil Flora Studies—IV, Non-spore-forming Bacteria in Soil; 60, Soil Flora Studies—V, Actinomycetes in Soil; 61, Facilities for Lysimeter and Outdoor Pot Culture Work at the Station; Circulars 49, The Cherry Leaf-beetle; 50, Periodical Cicada in 1916; 51, Some Insects Attacking the Pear, and Their Control; 52, Orchards—Location and Care; 53, Culture of Field Beans; and 54, Milking Machines.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$1,486. 97
United States appropriation, Adams Act.....	1, 365. 04
Balance from United States appropriation, Hatch Act..	13. 03
Balance from United States appropriation, Adams Act..	134. 96
State appropriation, including balance from previous year	144, 493. 27
Total.....	147, 493. 27

The New York State station maintained the high grade of its work through the year in the face of difficulties arising from the withdrawal of men from the staff for the Army and for emergency work.

NORTH CAROLINA.

North Carolina Agricultural Experiment Station, *Raleigh*.

B. W. KILGORE, M. S., *Director*.

A change of general administration occurred in the election of a new president to the college and a number of changes in the station staff resulted from the emergency calls of the Nation, which interfered to some extent with the prosecution of the projects in hand. The director also has charge of the extension work.

In addition to the Federal funds the station received nearly \$90,000 from the State department of agriculture for experimental work conducted in cooperation with it. Four thousand five hundred dollars were expended for permanent improvements.

Adams fund projects.—Studies on the toxicity of cottonseed meal have been carried on, especially on the effect of heating and extraction. It is believed that the poisonous principle in the seed is gossypol. When the meal is cooked a chemical change evidently takes place, as it is then much less toxic to pigs. This may be due to the formation of a derivative. Raw cottonseed meal, which is highly toxic when cooked at 100° C., to which temperature it is usually subjected in extracting the oil, has a much reduced toxicity, although still somewhat so, to pigs and rabbits. Cottonseed kernels extracted

with ether do not kill pigs but do kill rabbits. Butter fat and salt added to cooked cottonseed meal retard the effect of the poison, but the animals begin to die after 48 days. Poison meal did not kill hens in 170 days, and rats are much less susceptible than pigs or rabbits. The derivative produced by heating has not been fully identified, but a solvent has been found. In hot pressing cottonseed kernels none of the gossypol goes into the oil, but cold-pressed oil is very toxic and the meal somewhat so.

The relation of the geology and chemistry of soils to productivity and fertilizer requirements was studied on the station farm and on 15 outlying fields, analysis of the soil being supplemented by mineralogical examination to determine the form in which the constituents are present. The latter often throws light in cases of apparent contradictions between composition and the response of plants as shown in field tests, especially in the case of potash. Pot experiments were conducted to study the availability of the potash-bearing minerals from which the potash supply in the soil of different sections is derived. Potash derived from biotite and muscovite was shown by tests with small grains to be more available than that from the feldspathic group.

Pot cultures were also made to study the availability of apatite and iron and alumina phosphates, these being the forms in which phosphorus largely occurs in the soil. Eastern soils are low in phosphoric acid, but culture tests do not show it to be a limiting factor at present. Similar work has been carried out with the different forms of lime. It has not been found that lime has any effect in making potash more available in any of its forms. The field trials in connection with this investigation are made with corn, cotton, and a legume. In connection with the soil survey work, which is being done in cooperation with the Bureau of Soils, United States Department of Agriculture, the efficiency of different forms of nitrogen on different soil types is being studied by field experiments, considerable variation being found. Acidity appeared to be one of the factors causing the nonresponse to fertilizers of the black-lands soils.

The organism causing apple root rot has been isolated and identified as a species of *Xylaria*. Studies on the wilt disease of lettuce and clover indicate that they are due to two distinct organisms. An unidentified apple-twig disease forming poxlike lesions has been studied, but the organism has not been isolated.

Thirty distinct type plants have been isolated by self-fertilization from a single variety of cotton which had been secured by mass selection for five years. This shows the lack of uniformity in common varieties. Two strains have been tested to determine whether vigor is injured by self-fertilization.

The common and four-spotted cowpea weevils and the bean weevil have been controlled with air-slaked lime. Experiments in covering stored peas with lime to prevent the weevil from breeding are in progress. Early planting is recommended as an efficient means of control of the corn billbug.

The horticultural department has continued investigations on the transmission of characters in hybrids of *Rotundifolia* grapes. Floral types are transmitted to the progeny in definite ratios. It was found that in *Rotundifolia*, the upright stamen in hermaphrodite flowers was correlated with normal, viable pollen and self-fertility, while the reflex stamen was always associated with defective pollen. A large number of hybrids are now under observation. Studies on self-sterility in dewberries and blackberries have been nearly completed. Of the blackberries studied, the true varieties were self-fertile, while the hybrids were wholly or partially self-sterile. On the other hand, the true varieties of dewberries were self-sterile, while the hybrids were self-fertile. Investigation as to the origin of the dewberries showed that all varieties that were descendents of *Rubus trivialis* or the varieties in which this species predominated, were self-sterile, while those varieties originating from *R. villosus* were generally self-fertile. Pollen from most of the self-sterile varieties will successfully fertilize flowers of other self-sterile or self-fertile varieties. Fully self-sterile dewberry and blackberry plants, when self-pollinated, produce apparently as good fruit as when cross-pollinated. The results obtained indicate that by judicious and careful selection of varieties, one or several varieties may be included in the fruit plantation with a reasonable certainty of a good setting of fruit. In the case of partially self-sterile varieties and all of the recognized self-sterile varieties, a good pollenizer is absolutely necessary. Under ordinary conditions, several varieties should be included in the plantation to secure the best results from cross-pollination.

Work with Hatch and other funds.—A study of the cause of "trembles" or milk sickness in cattle, which is becoming quite common, showed it to be due to richweed, *Eupatorium ageratoides*, which will be further investigated as to its toxic principles.

The feeds most responsible for producing soft pork are peanuts and soy beans, and experiments are being conducted to determine how long it takes to overcome this condition with other feeds. The cause of the softening effect is also being studied.

Experiments on cattle feeding have been quite seriously interfered with by the high price of concentrated feeds, showing abnormal results as to cost of feeding. Forty head of cattle were carried over the summer, using corn silage and cottonseed meal in comparison with velvet-bean meal. Heavy feeding of cottonseed meal to calves and heifers to determine the effect on the reproductive organs caused

the animals to become abnormally fat, and it has not been possible to breed them. An experiment to determine whether lambs on heavy rations would withstand the effect of stomach worms by being kept in good physical condition showed the benefit of this treatment. Those on pasture alone all died, on pasture with a half-pound grain ration half died, and with 1 pound of grain three-fourths of the sheep were saved. Barbados sheep are reputed to be largely immune to the stomach worm. Pure-bred ewes kept at the station were found to be rather delicate and when bred to Rambouillet and Shropshire rams the crosses have not proved to be resistant to worms. No harmful effect was noted on feeding large quantities of cottonseed meal to sheep.

In the dairy department a study is being made of the cause of the onion flavor being imparted to the milk when these are fed to cattle. The presence of allyl sulphid as the probable cause will be sought for in the whole milk, cream, butter, and skim milk. Methods of treating the milk to eliminate it will be tried. Some difference was found in the response of cows to onion feeding.

Considerable work is being done by the poultry department on the mineral requirements of growing chicks and to determine whether the ordinary rations are deficient in this respect. The mineral analysis of the chick and of the feeds has been made, and feeding experiments by the addition of various minerals and mixtures in the rations carried out. Experiments were also tried to find if there was a limit of safety in feeding cottonseed meal to poultry, the results showing that there evidently is such a limit and that excessive feeding of this material is injurious.

For the control of tobacco wilt a rotation system was found to be most efficient. The *Fusarium* blight or wilt disease of soy beans was found to be caused by the same organism that produces cowpea wilt.

Considerable selection work has been done with cotton and some strains have been improved, one producing \$60 an acre more than the original variety. Four varieties have been found which are especially suited to the State. Similar work is being carried on with corn, soy beans, cowpeas, and velvet beans. The soy-bean-selection work has been done to raise the oil content, to improve it for yield of hay and seed, and for use as early hog pasture.

The following publications were received from this station during the year: Bulletin 237, Tobacco Culture in North Carolina; Technical Bulletins 11, Self-sterility in Dewberries and Blackberries; 12, Inheritance of Sex in *Vitis rotundifolia*; 13, Biological Investigation of *Sphenophorus callosus*; Circulars 33, Cow Records Pay; 34, Soy-bean Products and Their Uses; 35, Velvet Beans; How to Grow and Use, and the Annual Report for 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15,000.00
United States appropriation, Adams Act-----	15,000.00
State appropriation-----	89,490.51
Sales, including balance from previous year-----	5,506.77
Miscellaneous, balance from previous year-----	2,503.56
Total-----	127,500.84

The station has done a good amount of work of creditable grade. It is profiting by the cooperative arrangement with the State department of agriculture and is working closely with the extension department in bringing its results before the farmers.

NORTH DAKOTA.

North Dakota Agricultural Experiment Station, *Agricultural College*.

T. P. COOPER, B. S. A., *Director*.

The general condition of the work of this station was quite satisfactory in spite of some disturbing influences. War needs and war demands have interfered to some extent with the routine station duties, but, on the other hand, they have turned attention to the more immediate agricultural problems, the solution of which is of vital importance in bringing about a readjustment of agriculture to meet the needs of the Nation.

The appropriations for the station, the substations, and demonstration work remained the same as in the previous biennium. No serious changes were made in the station staff. The station has been relieved of all regulatory work. The substations have each been assigned definite live-stock problems, that at Langdon devoting attention to beef cattle, at Edgeley to swine, at Williston to sheep, and at Hettinger to dairy cattle.

Adams fund projects.—Investigations relative to the possible influence of the botfly, *Gastrophilus* sp., in the etiology of swamp fever have proved conclusively that this insect is not a carrier of the disease. The intoxications following the injections of *Gastrophilus* material are purely a manifestation of anaphylaxis and in no way differ from those caused by the use of any foreign protein. It was found that many parasitic species sensitize their hosts who, upon reinjection, will respond by anaphylactic reactions. Hog-cholera investigations were centralized on the influence of specific antibodies on the pathogenic and antigenic properties of the hog-cholera virus. There are indications that if the pathogenic properties of the virus are in any way reduced, the antigenic properties also cease to be active, and that the latter are far more vulnerable than the former.

Studies are in progress on the proteolytic activity and the ferments occurring in wheat on the soluble proteids of wheat and on the oxidases, to which the darkening of the outer coat of wheat is believed to be due. Wheat-breeding experiments have yielded some rust-resistant strains which are being given a thorough trial under rust conditions, attention also being given to their productive capacity and milling quality. Further trials with wilt and canker-resistant flax confirm the resistant qualities of strains previously obtained, especially N. D. R. 114. Wilt-resistant plants under abnormal conditions, as excessive drought or moisture, intense alkalinity, and injury by insects, are rendered more or less subject to attack.

The project on the factors influencing the action of microorganisms in the liberation and accumulation of available plant food in the soil was pursued mainly along the line of organic compounds as sources of energy for soil organisms. In general, sugars and fatty acids were found to be readily available, but the higher and more complex compounds less so. The subject of soil acidity has been under investigation. There is a decided loss of lime as calcium carbonate in soils that have been continuously cropped with wheat. The amount of magnesium remains about the same as in virgin soils, showing that continuous cropping disturbs the lime-magnesium balance. The presence or absence of lime is not the only factor in the production of what is commonly called "soil acidity," one of which is the presence of soluble iron and alumina compounds. There appeared to be but slight differences in the amount of iron and alumina in the cropped and virgin soils. It has been found that the solvent action of a solution of ammonium sulphate first removes the calcium and leaves the iron and alumina compounds in a soluble, toxic form, thus causing infertility. When calcium carbonate was added to the above soils and they were then treated with ammonium sulphate solution the results showed an increase of soluble lime and a decrease of soluble iron and alumina. Although there was a slight increase in soluble magnesia in all cases, the proportion of this to the soluble calcium was much less in all of the limed samples.

Work with Hatch and other funds.—A breeding circuit was started in 1910 in cooperation with the United States Department of Agriculture and a group of dairy farmers. In one herd at that time the average butter fat per cow was 131.9 pounds, giving a return over feed cost of \$16.90. In 1916 the average was 427.6 pounds per cow and the net returns \$90.24. The annual net profit for the whole circuit was \$68 per cow. This is a striking example of what can be done through better methods of breeding and feeding. Five cows out of 99 head of pure-bred Holsteins in this circuit produced more than 500 pounds of butter fat annually. At the Williston substation

200 head of range lambs were fed for 18 days on 6.5 acres of standing corn, then for 24 days on stubble, and 28 days on alfalfa hay with a small amount of grain gave a net profit over all costs of \$194.48.

The only variety of alfalfa that came through the severe winter conditions satisfactorily was the Grimm. Seeds from this crop are being sown in Texas to note the climatic effects on alfalfa characters.

Studies in soil fertility showed that soil on which wheat had been grown continuously for 30 years contained from one-fourth to one-fifth less nitrogen and one-fifth less phosphorus than virgin soil of the same type. During the last eight years of this series the yield of wheat was 28 per cent less than the first eight years. Manuring brome grass produced an increase of 72 per cent in the yield of hay. Clover has proved to be a more profitable crop in rotation than timothy or peas. The rotation giving the best returns was corn, wheat, barley, clover, and wheat. The annual acreage value of the crops produced in this rotation was \$24.49. Trials indicated that it was more profitable to haul manure directly from the barn to the field than to compost it. The application of manure and phosphoric acid produced only a slight increase in the yield of corn, oats, and barley, the increase not being sufficient to cover their cost. Clover showed no response to manure or fertilizer. Tests on the rate of seeding medium red clover showed that 5 pounds per acre were sufficient. Seed received from southern sections was later in heading and showed a lack of hardiness. White sweet clover showed a much less ability to withstand flooding and wet conditions than the red. Cutting it to a height of 4 inches or less resulted in almost complete killing out.

Trials indicated that hogging off is a very profitable way of marketing the corn crop. The amount of pork produced per acre was found to vary considerably and an extra acreage over that required when the corn is at its best should be planted. During three seasons these experiments have been in progress satisfactory returns were secured. In feeding alfalfa hay to brood sows to replace a part of the grain ration, those receiving a grain ration only consisting of two parts of crushed barley and one part of bran by weight ate 1.8 pounds of grain per hundred pounds of live weight per day, while those receiving all the alfalfa hay they would consume ate 1.2 pounds of grain. It was found that 0.6 pound of grain was replaced by 0.63 pound of alfalfa hay. Those eating alfalfa required only two-thirds as much grain to keep them in good condition. The litters from both lots were equally strong. It is thus practical and advisable to feed as much alfalfa hay to brood sows in the winter as they will eat, regulating the additional grain ration so as to keep them in good condition.

Experiments on the milk ration for dairy calves showed that it was not necessary or profitable to continue whole-milk feeding throughout the time they receive milk, provided some good substitute to supply the fat, such as boiled flaxseed, is used with the skim milk. An experiment on the cost of wintering steers showed that under North Dakota conditions steers could be carried through the winter in a satisfactory condition for about \$7 per head.

A soil survey has been made of all the substations and demonstration farms and will now be extended through the State in cooperation with the Bureau of Soils, United States Department of Agriculture. In variety trials for silage production Minnesota No. 13, Rustlers White Dent, and Mercer produced the largest yields of silage. The varieties vary largely in yield under different climatic conditions. Early strains of Rustlers White Dent, Dakota White Flint, and Gehu showed the highest percentage of dry matter when placed in the silo. In ear-to-row breeding with Minnesota No. 13 the difference between the highest and lowest yielding ears was 19.4 bushels. A trial with seed corn harvested in the milk, dough, glazing, and ripe stages showed that in the glazing stage it gave almost as good a stand and yield as ripe seed if carefully cured. It should not be harvested before this stage for seed. Corn grown on manured plats matured somewhat earlier than on unmanured ones and when grown in rotation with clover was of better quality than that grown with timothy.

Contagious abortion has become a serious menace to the live-stock industry of the State, and the veterinary department is devoting special study to this subject, particularly to a method of agglutination and complement fixation as a means of diagnosis and immunization by means of live bacterial cultures.

Plant-breeding work with brome grass has been extensively carried out to develop two distinct types—one that does not spread by means of root stocks and that will be particularly suited to the humid areas and easily destroyed and one that will produce a greater quantity of herbage in the plains region. Tomato breeding has resulted in the development of sufficiently early strains to make tomato production practical in the State. Extensive celery, sweet corn, and cauliflower variety tests are being carried out. Strawberry studies show that but little confidence can be placed in the so-called "pedigree" strains, which in most instances prove to be the poorest strains grown. Experiments indicate that limiting the number of young plants to one to each runner increased the yield from 25 to 150 per cent as compared with the natural habit of growth.

The farmer's home garden proved an interesting demonstration of what can be done on the farm. This was one-third of an acre in

size and supplied vegetables from May 15 to October 10, at which time all vegetables were harvested and stored for the winter. Sufficient vegetables of considerable variety were produced to supply a family of six and furnish a surplus for canning, drying, and storing. The wholesale value of everything produced on the plat was \$142.48, and the total cost of labor and seed was \$60.65, showing a profit of \$81.83.

A study is in progress on asparagus culture for rust-resistant stock, depth of planting, and methods of culture. Records are being kept of available ornamentals on dates of blooming, leaf fall, and other interesting data.

Small experimental silos, 2 by 4 feet, were used in a study of methods of storing alfalfa and sweet clover. Spoiling almost invariably occurred when the dry matter was less than 25 per cent. The material should be well cut and tightly packed.

Owing to the presence of rust and scab, much seed wheat from the 1915 crop was used. The seed laboratory found that this gave as good results as year-old seed in strength and percentage of growth, provided it had been properly stored free from moisture. About 20 per cent of the seed proved unfit for use.

The department of plant pathology has been studying the diseases affecting the roots and seeds of cereals and flax and their control, for which purpose treatment of the seed with a soap emulsion of crude creosote gave favorable results. A number of imperfect fungi caused diseases in wheat by penetrating the seed coat, sometimes even to the embryo. Such seeds not only transmit disease to their own seedlings but infect the soil. This shows the importance of close fanning, screening, and grading seeds, as such infected seeds are always lighter in weight than sound ones.

Extensive grazing experiments have been in progress in cooperation with the United States Department of Agriculture. The results show a gain of 1.8 pounds per day for the steers allowed 10 acres per steer, 2.2 pounds for those allowed 7 acres, 2.2 pounds for 5 acres, and 1.8 pounds for 3 acres. The average gain per steer was nearly 325 pounds for 5 months.

Marketing investigations have been devoted largely to the potato crop. It is apparent from this study that the largest loss in marketing this crop is due to the lack of information upon the part of the grower as to the demands of the market and lack of organization, and it is recommended that communities grow one pure variety; that storage be provided at the shipping point by the local association; that inspection and grading be provided for; and that a State association be organized to provide market information.

The following publications were received from this station during the year: Bulletins 116, The Influence of Energy Material upon the

Relation of Soil Microorganisms to Soluble Plant Food; 117, Composition of the Maize Plant; 118, I, Soya Bean Oil; II, Flax Studies; 119, North Dakota Wheat for 1916; 120, The Capacity of Wheat and Mill Products for Moisture; Special Bulletins of Food Department, vol. 4, Nos. 5-13; Circulars 14, Poultry Houses; 15, Practical Milling Tests; 16, Organizing Cooperative Associations; and the Annual Report for 1916, part 1.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15, 000. 00
United States appropriation, Adams Act.....	15, 000. 00
State appropriation, including balance from previous year	51, 990. 63
Sales, including balance from previous year.....	32, 219. 65
Total.....	114, 210. 28

The North Dakota station has much work of fundamental importance in progress, the results of which are proving of practical value to the people of the State.

OHIO.

Ohio Agricultural Experiment Station, *Wooster*.

C. E. THORNE, M. S. A., *Director*.

The work of this station was continued along the lines previously followed, increased attention being given to war emergency work toward the end of the year. C. G. Williams was made associate director and a number of minor changes were made in the personnel of the station staff without affecting its general policy. During the year a brick building 40 by 56 feet was erected, at a cost of \$7,500, for work in animal husbandry in the handling of meat and wool scouring. State appropriations of \$12,000 for rebuilding the station greenhouses and \$10,000 for the erection of a printery were made. Two State forests were established during the year, the Waterloo State forest at New Marshfield and the Dean State forest at Steece, \$10,000 being appropriated for this purpose. Two additional county experiment farms, one of 170 acres in Belmont County and one of 166 acres in Madison County, were established during the year. Ten such farms are now in operation, widely scattered over the State, in addition to three district farms and two forest tracts owned by the station, making 2,670 acres owned and 1,750 acres additional under operation.

Adams fund projects.—Studies were made on the mineral requirements in milk production, showing that cows do not digest enough lime, magnesia, and phosphorus to maintain an ordinarily liberal milk production, and consequently the body stores of these elements have

to be drawn upon, necessitating a rest period in which to recuperate. The negative balance of lime and magnesia could not be overcome by any system of feeding, or even by the addition of calcium carbonate and bone flour, although it was reduced. The phosphorus balance became positive. This work throws important light on the function of the leguminous feeds, with their high calcium content, in animal nutrition.

Work was actively prosecuted on the conditions affecting the physiology of the process of nitrification and the cytology of *Azotobacter chroococcum*. Preliminary observations revealed the errors encountered by using the methods in vogue, and a critical study has been made of these and improvements introduced in the determination of nitric nitrogen in soils, the titrametric determination of nitrites, the aeration method for ammonia, and the determination of nitric and ammonia nitrogen in the same sample. New and delicate methods of isolating and studying pure strains of nitrifying organisms were devised. This preliminary work was necessitated by the fact that the conventional methods of studying nitrification and nitrogen fixation were found to be entirely inadequate and unreliable. These refined methods are to be applied to the study of different phases of the problem. The exact knowledge of soil bacteriology has been shown to be very limited. There has been found to be a wide variation in the distribution and character of the *Azotobacter* in different regions and soils. It appears that the organism, although present, may continue practically inactive in certain kinds of soils, and the conditions necessary for stimulating their activity are being studied with promise of results of practical as well as scientific importance.

Some interesting problems in soil physics are under investigation. A method for the mechanical analysis of soils is being developed by which a more satisfactory separation can be obtained. This will be followed by a critical study of the physical properties of soil, the mineral nature of the soil grain, and a study of their colloidal coatings. Active progress has been made in the study of the phosphorus supply in virgin and cultivated Ohio soils by means of plat and field tests. Some results obtained along this line in a study of a black clay soil are of interest as furnishing an indication of the possibility of considerable amounts of phosphorus existing in organic combinations in some types of soil.

Studies on the effect of the nitrogen and phosphorus supply of the soil on the character and composition of wheat have shown that the largest percentage of protein was found in wheat grown on a soil deficient in available phosphorus and fertilized with nitrate of soda. Additions of untreated rock phosphate to soil fertilized with nitrate of soda resulted in an increased amount of phosphorus in the grain,

and also increased the yield. The effects produced indicate that plants are better enabled to utilize the phosphorus from rock phosphate when the conditions are made more favorable for plant growth by providing an available supply of nitrogen. The phosphorus-nitrogen ratio supplied by fertilizers and differences in the availability of the nitrogen have apparently been factors responsible for variations produced in the protein and phosphorus content of wheat.

The protein content of wheat grown on soils where nitrogen was supplied by organic carriers was less than when nitrate of soda was used. Milling and baking tests of wheat grown under different conditions of fertilization with phosphorus and nitrogen show that there was a tendency for the protein in the flour to parallel the increased protein content of the wheat when the soil supply of the available nitrogen was increased, and the loaf volume of bread obtained in baking tests followed the protein content of the wheat and flour.

Work on the sulphur requirements of crops, some results of which have already been published, is to be continued, using small field plats treated with sulphur and sulphates with various combinations of fertilizers, to determine the effect on plant growth and changes produced in the soil.

Studies were made on the variation of protein content, size of grain, tillering, and length of head in pure-line breeding of wheat. There appears to be no variation of heritable characters, which are apparently so strongly fixed in wheat that they can not be varied by present methods of breeding.

Work with Hatch and other funds.—Extensive and valuable lines of investigation have been in progress under the Hatch funds, with liberal State appropriations. In studies made of the effect of liming and loss of bases from the soil it was found that ammonium sulphate accelerated the decomposition of carbonates. The evidence obtained by laboratory studies did not indicate that acid phosphate had any important influence on the depletion of the supply of bases in the soil. Manure appeared to exert an influence toward the conservation of the bases supplied by lime treatment. The use of apple pomace as a mulch caused an increase in the lime requirement, while sawdust similarly used had little effect. Both field observations and laboratory tests show that organic matter furnished by green crops does not cause soil acidity. Results obtained from a comparison of plowing clover under in the fall and allowing it to lie on the ground during winter indicate that the loss of organic matter in the latter case may be as great as when the crop is fed to live stock and the manure returned to the soil. Experiments conducted to determine the effectiveness of various treatments in conserving the nitrogen of manure have shown that sulphur was effective in preventing loss of

nitrogen from urine. The untreated urine lost 80 per cent of its total nitrogen, while treatment with sulphur reduced the loss to 10 per cent.

For a number of years the agronomy department has been laying more and more emphasis on the culture of the soy bean in Ohio. It is now applying to this crop the methods of selection that have been employed in the improvement of wheat and corn, and strains have been developed which are regularly yielding several bushels per acre more than the original varieties from which they were derived, two such strains having reached 5-year average yields of 28 and 29 bushels per acre. The place of the soy bean as a substitute for oats in rotation, especially for southern Ohio, is receiving careful attention. A rotation of corn, soy beans, wheat, and clover has been in operation for several years. Wheat following soy beans has yielded a 5-year average of 10 bushels more per acre than when following oats or potatoes. The use of soy beans as a food for animals and man is also being studied.

The work on rotation of crops is extensive and elaborate, covering almost every combination of important Ohio crops in two, three, four, and five-year rotations. The results of many years' experiments on the rate of seeding wheat show that not less than 8 pecks per acre is best. Three seasons' experiments with 4 and 8-inch drills for wheat and oats, with different rates of seeding, failed to show any marked superiority for either width or row. In experiments with corn it was found that at the latitude of the station the best yield was obtained when planted during the first half of May. Drilling gave slightly larger yields than check-rowing, and in check-rowed corn planted 42 inches apart each way the most satisfactory yield of merchantable corn has come from 3 stalks to the hill.

In experiments with fertilizers and manures, most of the soils thus far treated have responded profitably to applications of phosphorus, the average increase in experiments which have been in progress for 24 years being 80 bushels of wheat for 1 ton of 14 per cent acid phosphate. Muriate of potash has produced a further increase in yield and at prices prevailing before the European war this salt was used in most cases with some profit. Nitrate of soda was found profitable only on the most exhausted soils. Under conditions prevailing in 1917 there is no margin of profit in the use of fertilizers carrying potash and but a narrow one for those containing nitrogen. The long-continued experiments of this station with farm manures, however, show that the Ohio farmer may be independent of purchased potassium and nitrogen in the fertilization of his fields. As a 24-years average, 8 tons of barnyard manure which had lost much of its value by exposure for several months in the barnyard before going to the field increased the average yield of wheat by 13 bushels,

followed by an increase of 3,600 pounds in the two succeeding hay crops. Where the same quantity of manure was taken directly from the stable and applied to corn it increased the yield on an average for 20 years by 23 bushels, followed by an increase of 10 bushels of wheat and 1,300 pounds of hay without further manuring.

In the field study of soil fertility, 2,300 permanent plats are now under experiment, mostly of one-tenth acre in size, located in 14 different counties and on as many different soil types. Of some of these a continuous history for 24 years is now available.

A large amount of work is being done in the comparison of varieties of fruits and in the study of the adaptation of varieties to different soils and climatic conditions. Owing to the confusion in the naming of varieties the station is attempting to standardize the nomenclature of the currant and now has more than 100 varieties on the grounds. A special orchard is devoted to a study of promising seedling apples. In connection with the orchard experiments attention is paid to improved methods of spraying, fertilizing, and pruning. It has been found that a combined mulch and fertilizer treatment is apparently best, and the use of a small amount of complete fertilizer for this purpose is recommended.

A large amount of work on vegetables is being carried on in the greenhouse, including testing of varieties, crossing, selection, and breeding for disease resistance. Encouraging progress has been made in the development of strains of cabbage resistant to *Fusarium* wilt, or "cabbage yellows," a disease threatening the existence of the cabbage industry in the State.

Extensive investigations are being carried on in the propagation of forest trees, reforestation, forest arboretums, forest management, wood utilization, and forest surveys. In cooperation with the Bureau of Crop Estimates, United States Department of Agriculture, a study has been made of the distribution of the wild garlic, which was found to be widespread, occurring in 78 counties. Fuel oil, when applied early in the season, was successful in controlling this weed.

Further evidence has been obtained respecting the agency of honey-producing insects in the transmission of fire blight of the apple and pear, showing that blight-producing organisms may be carried by aphids, leaf-puncturing, and other insects, from the cankers or other diseased tissues to those that are healthy; that it may live for several days in the nectar of the blossoms or in honeydew and may be transmitted by bees in search of pollen or nectar. A plant disease survey of the State is in progress in connection with which several plant diseases have been identified and studied.

The life history of the lesser peach tree borer, which is causing serious injury in the older peach-growing districts, has been worked out; also work on the life histories of the codling moth, the green

soldier bug, and the clover leaf tyer. The campaign for the control of the Hessian fly, which was started in Miami County in 1915, has been successfully completed by inducing a large majority of the farmers to delay seeding until this danger was past, this point being determined by the installation of breeding cages and keeping an egg-laying record at the county experiment farm. This was followed by the pasturing or plowing under of volunteer wheat which was found to be infected by the fly. The outcome of this campaign has been the reduction of fly infestation to the normal point.

Further entomological work includes observations on the second brood of codling moth, a study of the onion maggot, the long-horned, wood-boring beetles, nut weevils, cankerworms, small fruit insects, and forest and shade-tree insects. Orchard spraying experiments have been conducted for 10 years, including a study of spraying mixtures and machinery. Other lines of work include a study of the Pentatomidæ, experiments on the control of the grape berry worm, methods of control of the apple flea weevil, and observations on the transmission of cucurbit wilt.

In the field of animal husbandry studies are being made looking especially to economy in animal feeding, having in view the increasing importance of conserving the grains for human food. Experiments are in progress on the comparison of light, medium, and heavy grain rations for fattening young cattle, on the use of corn alone compared with corn and oil meals, and on the effect of age on the rate, economy, and character of gains. Pigs fed 75 per cent of a full ration of corn while running on a rape pasture made a somewhat slower gain but at materially less cost per pound than those receiving the full ration. Pigs given all the corn they would eat did not consume enough green feed to balance the ration and made less economical gains than did those that received a limited allowance of corn. Lambs fed leguminous roughage with a grain ration produced gains at a lower cost, were better finished, and worth more on the market than those fed a roughage of straw or stover. A comparison between red clover and alfalfa hay as roughage showed no practical difference in value.

Poultry experiments have been conducted comparing range with confinement in the summer care of laying hens. It was found that the value of the range amounted to from \$10 to \$31 an acre in the lower cost of feed and additional eggs produced.

A study was undertaken for the purpose of discovering whether any relationship exists between the iodine content of foods and the occurrence of goiter, which is prevalent to a marked degree in certain localities. In this study 927 samples of animal and vegetable products were examined, collected from 25 States, from soils of different origin and differently treated, from regions of interest be-

cause of prevalence or rarity of goiter, and of foods collected in the open market. The general conclusion reached was that iodine is a comparatively unusual food constituent, that its presence in food is commonly accidental, and that no causal relation exists between the presence or absence of iodine in the food and the prevalence of goiter.

The following publications were received from this station during the year: Bulletins 296, Ohio Weather for 1915; 299, The Iodine Content of Foods; 300, Thirty-fifth Annual Report, 1916; 301, Orchard Rejuvenation in Southeastern Ohio; 302, Marketing of Woodlot Products; 303, County Experiment Farms in Ohio—Annual Reports for 1915; 304, The Possible Wayne County Farm; 305, Raw Phosphate Rock as a Fertilizer; 306, Liming and Lime Requirement of Soil; 307, The Lesser Peach Tree Borer (*Synanthedon pictipes*); 308, The Mineral Metabolism of the Milch Cow, II; 309, Spray Calendar, with Seed, Soil, and Disinfection Treatment Methods; 310, The Green Soldier Bug, *Nezara hilaris*; 311, Distribution of the Ohio Broods of Periodical Cicada with Reference to Soil; 312, Soy Beans—Their Culture and Use; 313, Dependable Fruits—Apples, Pears, Plums, Peaches, Cherries, Small Fruits; Monthly Bulletins, vol. 1, Nos. 7-12 and vol. 2, Nos. 1-6; and Illustrative Fair Exhibits, Ohio Agricultural Experiment Station.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation, including balance from previous	
year	322,658.88
Sales	31,196.38
Total	383,855.26

The Ohio station has done very valuable work, not only for its own State but for agriculture in general. Much of the work has been consistently followed out for a number of years and it is evident that that which has been longest in progress is now yielding results of the highest value, but no part of this work is of greater importance than its outstanding demonstration of the absolute futility of expecting to arrive at any dependable knowledge of the soil from a single season's experiments.

OKLAHOMA.

Oklahoma Agricultural Experiment Station, Stillwater.

W. L. CARLYLE, M. S., *Director*.

The affairs of the station made satisfactory progress along the lines of work with which it has been occupied for some years. Some changes in the staff occurred but involved no serious interruption,

most of the changes being among the assistants. The State appropriations were a little over \$5,000.

Adams fund projects.—The inheritance of drought resistance in black-hulled white Kafir corn has been carried on by selection under rather adverse climatic conditions and insect depredations. The head-to-row method has been followed and about 18 of the more important characters are being worked out. The chemistry of the grain sorghums has been studied this year mainly in regard to the fats. Milo-maize fat was found to have a much lower melting point than that from other varieties. The silage from the grain sorghums has been compared with corn silage by chemical analysis, but no marked characteristic difference was found. The temperature of the silo was noted as having reached the maximum in 30 to 40 days after filling.

The effect of feeding peanut meal to hogs was studied with two lots, one receiving nothing but peanut meal, the other being finished off with other feed stuffs after 40 days. With the peanut fed lot the fat had a lower melting point and a higher iodine number than the other lot. The report of the judges on the quality of the meat stated that for the first lot "the ham lacked uniformity of color, was soft, coarse grained, and open in texture." The report on the second lot was, "the ham showed firmness of grain and consistency but was lacking in marbling and covering of fat."

The cause of the falling of tomato blossoms is now believed to be due more to dry air and soil than to thrips, and while the study of the latter as a possible cause will not be given up, it will be prosecuted more from a physiological standpoint as a soil-moisture problem. Cultural tests show that the yield is influenced directly by methods of cultivation. Straw mulch was quite effective in increasing the yield. Staking and pruning were found to give stronger blossoms and earlier and larger fruit.

Treatment of the impervious Kirkland upland soil at the station has been studied. The root development has been found to be less than in other types of soils. Lime prolongs the period during which the land can be worked. Dynamiting and deep tillage did not overcome the trouble.

The entomological department has various projects under investigation. The life history of the stick-tight flea of poultry has been largely worked out and similar studies are in progress on the white ant and the fish moth. The corn-plant louse and the cowpea louse have been studied. Annual generations and true-sex forms have been obtained of the latter, but the percentage of male forms was small. The artificial fertilization of queen bees and the total and comparative reproduction of different strains of bees have been investigated.

Extensive sheep-breeding experiments have been in progress and a large number and variety of crosses have been made. Some very desirable types have been secured, combining early breeding qualities, a very satisfactory wool, and a good mutton type. The Shropshire was found to transmit the mutton conformation very strongly, the Merinos and Rambouillets transmitting the density and fineness of fleece. Data are also being kept of the character of the wool in all of the crosses. Some of the rams of all the different crosses, except those having 75 per cent Shropshire inheritance, have grown horns, although a few rams having 25 to 50 per cent Shropshire inheritance have no horns. The horns are not so likely to occur in the females, and have never occurred in ewes possessing 50 per cent inheritance of the Shropshire breed or with 25 per cent of Shropshire and 50 per cent of the Merino, where the remaining 25 per cent was Dorset. Ewes having 50 per cent Merino and 50 per cent Dorset inheritance have in every case possessed strong horns, of about the same size as the horns of the pure-bred Dorset ewes. The indications are that the hornless character of the Shropshire is dominant in the female offspring. The dark-brown color markings of the Shropshire are equal in power of transmission to the white color markings of the Dorset, Merino, and Rambouillet. The absence of folded skin in the mutton breeds appears to be dominant over the presence of folds in the fine wool breeds. The Dorsets have shown the highest percentage of prolificacy.

A study of the vitality of hog-cholera virus showed considerable variation. The results of desiccation were not uniform. One sample had not lost its virulence after 104 days, while some commercial samples lost virulence after 28 days. The length of time a single treatment with serum alone will protect was studied, and it was found that 40 days after vaccination pigs remained healthy when put with sick pigs. Inoculation after 53 days gave some of them cholera, although some retained their immunity for 82 days. They were more susceptible to vaccination than to exposure to sick hogs.

Research on the development of fruit buds has been very much interfered with by the poor condition of the material worked with, the orchard soil being apparently deficient in humus and nitrogen and the trees being very subject to disease and insect depredations. This will give an opportunity of selecting the more resistant varieties. The apple trees used in this project became badly infected with apple blotch, and spraying, cultivation, and pruning experiments were started to control this. It was demonstrated that blotch can be controlled by Bordeaux mixture, but it required six applications, which makes the expense rather high for commercial use.

Work with Hatch and other funds.—Numerous experiments have been carried out with Sudan grass, including rate and date of seed-

ing and the stage in which it should be cut for hay. During the season of 1915 a dwarf plant was found growing in a field of common Sudan grass. This grew to a height of only 2.5 feet, with fine stems and leaves. The seed from this plant was saved and sown by itself in 1916. This grew to a height of 4.5 feet on bottom land. All the coarse plants were pulled up. The seed from this crop gave a good growth on upland alfalfa sod, of an average height of 2.5 feet. The coarser plants were again removed. This dwarf strain has especially fine stems and leaves and produces seed as readily as ordinary Sudan grass. It matures earlier than the common variety and produces a hay that should be equal to timothy. Owing to the fineness of stem it will cure much quicker and can be handled with less labor than standard Sudan grass.

A large amount of variety and fertilizer work with forage and grain sorghums was carried out. Among the varieties of oats on trial only one came through the winter without injury. Breeding and selection of cotton is being done. Attempts are being made to find a variety of bean that is not subject to blight, the tepary beans proving to be the only one that did not blight but they did not fruit.

Pasture experiments with sheep, comparing Bermuda grass with Sudan grass and sweet clover, showed the superiority of the two latter.

In the poultry department the protein of beef scrap, cottonseed meal, and peanut meal were compared for feeding pullets. The beef scrap was found to be superior.

Investigations in commercial ice-cream making, using skim milk emulsified with butter, are in progress in determining the correct temperature of emulsification for holding the mixture before freezing and after pasteurizing.

The germ of honeybee paralysis has been isolated. Trials have been carried out to find the best commercial variety of bees.

A tractor experiment on a 73-acre field to study its economy and utility is being tried, in which careful cost accounting will be kept, all of the work being done with the tractor as far as possible.

The horticultural department is carrying on a number of experiments, including the growing of trees for fence posts, pecan investigations, a study of the sweet potato and its diseases, and variety tests with vegetables, bush fruits, orchard fruits, and grapes.

The following publications were received from this station during the year: Bulletin 111, Sheep Industry in Oklahoma; 112, A Study of the Effect of Cottonseed Meal versus Beef Scrap upon the Egg Production, Fertility, and Vitality of Poultry; 113, The Locust Borer; 114, The Determination of Fat in Certain Milk Products; 115, Sudan Grass Silage; Circulars 41, The San José Scale, *Aspidiotus perniciosus*; 42, Stallion Registration and Licenses for the Year 1916; and 43, Information for Horse Breeders.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15, 000. 00
United States appropriation, Adams Act.....	15, 000. 00
State appropriation.....	5, 154. 26
Sales, including balance from previous year.....	9, 065. 85
Total	44, 220. 11

The policy of the station is a progressive one, and it is taking up problems of direct interest to the agriculture of the State.

OREGON.

Oregon Agricultural Experiment Station, *Corvallis*.

A. B. CORDLEY, M. S., *Director*.

The abolishment of the State crop pest commission reduced the work of the departments of horticulture and plant pathology which had cooperated with it to a considerable extent. Otherwise, the work has progressed satisfactorily along the lines in which the station has been engaged.

A number of changes occurred in the staff among the assistants, which, however, occasioned no serious break in the more important projects on hand. The legislature made appropriations of \$5,000 for miscellaneous work at Corvallis, and \$10,000 for cooperative work with the United States Department of Agriculture, from which source \$11,735 was available. The State made appropriations for the support of the seven branch stations amounting to \$38,700. Funds were also provided for a new veterinary and a horticultural products building. The former will be used both for instructional and experimental work. The dairy barn has been remodeled at a cost of about \$3,000 and a general library building is in course of erection. A new hog barn has been provided at a cost of about \$5,000.

Adams fund projects.—Irrigation investigations have been conducted with dwarf pear trees in pots, in which the amount of water in both dormant and growing conditions is under control and observations are made at frequent intervals on the growth as affected by the amount of water supplied. It is found that the trees show great individuality in this respect. There are immediate as well as cumulative effects of variations in the amount of water applied.

A total of about 20 different types of pruning are being carried on in an orchard of 1,200 apple trees. Winter and summer pruning and a combination of the two are included in this series. The growth of fruit spur and fruit bud formation as influenced by the type of pruning is being observed. There appears to be a definite relation between the leaf area of a tree and its leaf bud formation. Microchemical studies are also being conducted to determine the influence

of leaf area upon the amount of sugars and starches stored in the buds and twigs, and the relation between storage of carbohydrate material in the buds and their function so far as the formation of flower parts is concerned.

It has been discovered in connection with the study of the life history of the organism causing cherry-tree gummosis that it attacks the young foliage of the sweet cherry tree during the moist weather of spring. The bacteria oozing from blighted spurs and buds or from cankers on the branches may be carried by rains to the foliage beneath, where they evidently enter the stomata. Spots are produced which enlarge, turn brown, and often fall out from the leaf, causing a ragged appearance. The connection of the foliage infection with the carrying over of the disease from one year to the next is to be studied. Methods for its control by the use of wrappings are being studied, also the value of lime in the soil as a possible means of lessening the susceptibility of young trees to the disease. The variety known as Major Francis is said to be resistant to bacterial gummosis and will be tested for this purpose.

Incubation investigations have been pursued, the primary purpose of which is to determine the cause of the heavy losses in artificial hatching and brooding. The phases of the question taken up are the influence of moisture, ventilation, temperature, and the chemical composition of the chick as affected by different degrees of humidity. A comparison was made of the hatchings from incubations with and without moisture and under hens. The results may be summed up as follows: Eggs in the dry incubator gave a considerably lower percentage of pipping than those in the moist incubator or nest, the chicks were smaller and contained a lower percentage of moisture. The dry incubator chicks had a larger amount of unabsorbed yolk and less tissue and the yolk mass contained a higher percentage of total nitrogen, ash, lime, and phosphoric acid than in the case of chicks incubated by other methods. The same difference in composition was noted in the tissues of the chicks themselves. Chicks incubated in the moist incubator and hatched under the hen showed very slight physical and chemical differences. The optimum of moisture and ventilation has not as yet been determined.

Chemical investigations of spray materials have demonstrated the value of tricalcium arsenate, which is cheaper than lead arsenate. Pure preparations of the tricalcium arsenate and of calcium hydrogen arsenate were prepared and their properties studied, these being the only arsenates of calcium which would be of practical use as insecticides. The calcium hydrogen arsenate is quite soluble, which would perhaps cause burning of the foliage. Field tests confirmed the value of the tricalcium salt as an insecticide. Lead hydrogen arsenate was found to have a higher killing efficiency at a given dilu-

tion than either calcium or basic lead arsenate. It required a longer time to kill mature than young caterpillars. All of the arsenic devoured by an insect is not assimilated, some passing through the intestinal tract. Lead hydrogen arsenate was assimilated readily and most of the arsenic was retained in the tissues, while much of the basic lead arsenate was found in the excrement. It is not recommended to use calcium arsenates alone as a spray material, but when used in combination with lime-sulphur or an excess of calcium oxid it is apparently a safe and effective insecticide. A test of nicotin sulphate as an ovicide for codling moth-eggs showed an efficiency when used alone of 84 per cent and used with soap, of over 99 per cent. The observations seem to indicate clearly that much more dilute arsenical solutions than are ordinarily used would be effective providing the solutions could be applied evenly. A strength of 1 pound of arsenate to 400 gallons of water gave a high efficiency in laboratory tests. It is believed that 1 pound of arsenate to 100 gallons of water will prove sufficient for effective control in the field, providing an efficient spreader could be found.

The life histories and range to other host species of the scolytid beetles attacking the Douglas fir have been worked out and control methods studied. The White Aveline filbert was found to be most susceptible to bacterial blight. A study of the insect transmission of the disease, of its control by spraying, and the development of a resistant variety is under way.

One phase of the work on the biochemical changes involved in the activities of soil bacteria has been a study of the formation of ammonia from protein substances, as this is a measure of the bacterial activity. The results have indicated that the rate of liberation of ammonia from protein and closely allied substances in the soil is due in a large measure to the chemical nature of the protein substance. The rapidity of the liberation of ammonia varies greatly with different protein substances, some showing no change after a few days, others continuing to ammonify for long periods. The same organism does not act on different proteins alike. The bacterial action is very similar to acid hydrolysis, and it is probably of this nature up to the formation of the amino acids. No toxic substance is ordinarily found that would inhibit the complete ammonification of a protein.

In the field, studies have been made of the effect of various degrees of moisture on bacterial activity and on the effect of acidity on *Bacillus radicicola*.

Work with Hatch and other funds.—Chemical investigations have been undertaken on the nature of soil acidity and the relation of lime to its correction. A comparison has been made of all known methods for determining soil acidity. The results lead to the con-

clusion that the present knowledge and conception of this factor do not permit of any other than an empirical or approximate method for its determination. Pot experiments are in progress to determine whether its action is due to the correction of alkaline conditions or to its effect on bacterial activity. A soil survey of this part of the State showed in most instances a medium potash content, a rather high calcium content with little of it, however, as carbonate, and a rather low but available supply of phosphoric acid. Nitrogen was found to be the limiting factor in most cases.

The number of sheep that can be carried per acre and the money cost of sheep raising have been worked out, but will need repetition to fix them more definitely. It was found on an average that 0.48 acre of pasture and 0.3 acre in cultivated hay or pasture were required for each head of sheep. These figures can be applied to cattle on the basis of six sheep being equivalent to one head of cattle. In an experiment on fattening steers on corn silage, as compared with alfalfa hay, it was found that better results were obtained by chopping the hay.

Considerable experimental work has been carried on in growing and fattening hogs with various feeds. Coconut meal which has recently come on the market as a feeding stuff on the Pacific coast has given good results for maintenance but not for fattening. The use of whey for fattening both grown and growing pigs and for their maintenance has not given satisfactory results. Good gains were obtained by the use of the self-feeder. The value of dormitory garbage for feeding purposes is under trial. Work on the cost of horsepower and the factors influencing the same has been continued.

The bacteriological department has manufactured and used, through the office of the State veterinarian, 7,800 doses of vaccine for hemorrhagic septicemia with gratifying results and the disease, which seriously threatened the live-stock industry of the State, has been held in bounds. Sufficient cultures of legume bacteria to inoculate 12,000 acres have been distributed during the year.

Striking evidence has been secured that many diseases of the potato are transmitted through the seed and that there is serious loss through planting seed which has no external indication of disease. The superiority of selected and tested seed has been demonstrated. It was found that pieces from the eye end gave more vigorous plants and higher yields than those from the stem end of the same tuber. Seed tubers affected with the *Fusarium* wilt did not necessarily cause symptoms of the disease to reappear in the offspring or affect the yield in all cases. A storage rot due to *Fusarium coruleum* appears to be the principal cause of loss of potatoes in storage. A serious wilt disease of potatoes in western Oregon was found to be caused

by *Verticillium albo-atrum*. This was found to remain alive in the soil to a depth of 6 inches for some time. Further studies will be made of its life history and control.

A survey of the potato sections revealed the occurrence of a number of diseases not previously reported as prevalent in the State. *Rhizoctonia crocorum* was found to be quite destructive in certain sections and investigations are begun as to its native host plant, its life history, dissemination, and control. More or less detailed investigations of a large number of diseases have been undertaken, including a root rot of hops apparently caused by a species of *Pyrenochaeta*, a bacterial root rot of celery, diseases of broccoli and flax, the onion mildew, and a root rot of beets due to a species of *Phoma*. Fruit-tree diseases and their control by sprays of various kinds are being studied. Among these are apple scab and anthracnose, various bark cankers of the pear and apple, a cedar rust disease of pears, peach blight, and various diseases of the prune. Spraying has given good results in the control of the brown rot and Bordeaux gave the best results against the *Cylindrosporum* leaf spot of the prune.

The effect of ligating the milk veins in relation to milk secretion has been tried with no results showing that this has any effect. An attempt is being made to fix the character of multiple birth in cattle, three sets of triplets having been secured for breeding purposes, all being full-sized, normal, thrifty calves. These will be bred and if offspring are secured inbreeding will be tried.

Observations have been made of the conformation and quality of the udder and its relation to milk secretion. It was found that very few heavy-milking cows have udders that will "milk down" until after they have been in milk several months. There is considerable variation in cows in regard to the length of time the tissue which imparts the body or "meaty" quality to the udder remains after freshening, varying from two or three months to the entire period of lactation. In practically all cows it disappears when the cow is dry. The nature of the tissue will be studied by X-rays and histological methods, also its relation to the milk secreting function.

The use of pepsin as a substitute for rennet in cheese making has been successful. Used at the rate of one-fourth ounce to 1,000 pounds of milk, coagulation takes place as quickly as with rennet used at the rate of 4 ounces. The curd is not so smooth or tenacious as rennet curd but this can be remedied by setting with pepsin at 88° F. The time required to complete the process of cheese making is not affected by the coagulant used. The cost of the pepsin is about one-fourth that of rennet and when properly used makes a satisfactory substitute.

From the extensive irrigation and drainage experiments that have been in progress for some years, it is evident that crop rotation and

the use of manure are of special value in connection with irrigation farming where crops removed are large and large quantities of refuse need to be returned to the land. Proper irrigation increases bacterial activity of the soil and is an aid in building up the humus content and water capacity. With manure, rotation, and irrigation, the water cost has been decidedly lowered. Overirrigation is the greatest menace to irrigation agriculture and the economical use of water is the greatest need. Meadow crops are found to require a relatively large amount of water as compared to grain, while cultivated crops require less than grain, showing the importance of crop rotation and diversity of crop where only a moderate amount of water is available. In some localities the application of potash has resulted in a more efficient use of water; in others, sulphur has had the same effect.

The life history and method of control of the peach and plum root borers have been studied. The results indicate that the various sulphur, resin, and soap washes are ineffective, asphaltum with felt wrappings giving better results.

An extensive study of the vetches is under way in cooperation with the United States Department of Agriculture, including the choice of varieties for different purposes, the time, rate, and depth of seeding, the effect of lime, and a botanical study to reduce the synonymy of the cultivated varieties. The common vetch is one of the best of the forage varieties. It has been used in silage, alone and in combination. With some varieties it was found necessary to add water to produce good silage. The horse bean shows great promise as a grain plant in the State and culture experiments will be tried with it. Variety trials of seed flax have given good results, yields as high as 23 bushels per acre being secured from strains of Dakota 155. Seeding from 35 to 45 pounds per acre gave the best yields. Flax for fiber purposes was grown, varying in height from 2 to 4 feet. Seed produced in this country proved to be as good as imported flaxseed. Some correlation studies have been begun of the hardness and gluten content of wheat which have been found to hold quite well within definite varieties.

Strawberry breeding has resulted in some very promising seedlings which will be propagated for distribution. Bud-selection work is giving results both of practical and scientific value. Similar results have been obtained in prune breeding. Loganberry pruning experiments and nut variety investigations with filberts, walnuts, and chestnuts are being carried on.

The effect of artificial pollination of the tomato is noticeable. The average greenhouse tomatoes where no pollination is done produce from 33 to 45 per cent of a crop, while with pollination from 60 to 80 per cent of the total blossoms produced marketable fruit. The cost of pollination amounts to but 2 or 3 cents a plant. The

first 10 to 14 days of blossoming is the best time for this and it should be repeated every 3 days through the blooming season. The results obtained in orchard treatment show that nitrogen applied at least a month before the trees bloom has a strong influence on the blossoms, the percentage of set, color, and size of foliage, the general vigor of the trees, the size and color of the fruit, and produced more resistance to frost.

Cauliflower proved to be a good crop to grow during the winter in the greenhouse, intercropping with radishes. The average returns were 5 cents per square foot, sufficient to pay the overhead charges of the greenhouse during that time of the year. The crop required three and a quarter months from seed to cutting, which was begun early in February. Variety tests of tomatoes, head lettuce, and squash were made.

Quite extensive work on poultry breeding is carried on along the lines of inheritance of heavy egg production, the age of the fowl as a limiting factor, early maturity of the pullet as a measure of egg-laying capacity, relative influence of sire and dam in the production of female offspring, effect of close inbreeding on production and on the vigor of the offspring, and on the inheritance of heavy egg laying as related to longevity. As a result of this work there have been developed heavy laying strains of Barred Plymouth Rock, White Leghorns, and a strain developed from a cross between the two that has been named the "Oregon." There is a large call for breeding stock from these, beyond the capacity of the station to supply, from all sections of this and from foreign countries. One pen of 10 hens laid an average of 250.2 eggs during the first laying year and 197.3 the second year. The results of a study of the correlation between type of conformation and egg-producing qualities so far are against the theory that the type gives any certain indication of laying capacity. Early laying pullets will as a rule prove to be the best layers throughout the year.

Rotations to determine the best long and short rotations for maintaining and increasing fertility under western Oregon conditions are being continued. Tests have shown that fertilizers can not be profitably used over a considerable area of the State except on certain types, as some red hill land and the black, gravelly loam soils of the Willamette Valley, where sulphur and superphosphate show some increase.

Sterility in cows has been studied and clinical evidence indicates a close relationship between uterine disturbances and ovarian disease. Microscopic studies of cystic ovaries show that the cysts may originate from either graafian follicles or *Corpora lutea*. In no instance was *Bacillus abortus* isolated. One of the first symptoms of cystic ovaries is a marked decrease in milk flow. Investigations of

the so-called walking disease of horses indicate some chronic poisoning from forage as a probable cause, but no poisonous weed has been found in the hay fed to affected animals nor is there any evidence of an infectious character. The disease appears to be more prevalent than was at first suspected.

The following publications were received from this station during the year: Bulletins 134, A Study of Variation in Apples During the Growing Season; 135, Variation of Internal Structure of Apple Varieties; 137, The Drainage of "White Land" and Other Wet Lands in Oregon; 138, The Pollination of the Pomaceous Fruits—III, Gross Vascular Anatomy of the Apple; 139, Pruning Investigations; 140, The Economical Use of Irrigation Water; 141, Report of the Hood River Branch Experiment Station for 1916; 142, The Culture of Small Fruits on Irrigated Sandy Land; 143, New Facts Regarding the Period of Ascospore Discharge of the Apple-scab Fungus; and 144, Dry-farming Investigations at the Sherman County Branch Experiment Station.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation, including balance from previous year	45,430.62
Local community	2,000.00
Sales, including balance from previous year.....	29,089.86
Total.....	106,520.48

The station has a large amount of valuable work in progress and is aiding very materially in solving the agricultural problems of the State. It is giving a good account of the appropriations accorded it.

PENNSYLVANIA.

The Pennsylvania State College Agricultural Experiment Station, *State College.*

R. L. WATTS, D. Agr., *Director.*

For the first time in its history the station secured a State appropriation of \$2,500 for each of two years. The station has the use of all the land necessary for experimental purposes on the college farm of 1,800 acres.

A number of changes occurred in the staff. S. W. Fletcher was appointed in the department of horticulture and F. Rasmussen in dairy husbandry. Numerous changes were made in the assistants, many of the places being satisfactorily filled, but some interruption of the work resulted in some of the departments.

Adams fund projects.—The project on the causes affecting the yield and quality of apples has been mainly along the line of fer-

tilizers and cultural methods. With no fertilization, mulching gave the largest growth and most fruit in young orchards, while the tillage and cover-crop method was slightly better in mature orchards. The use of annual cover crops did not show much advantage over tillage. The use of tilled intercrops with proper fertilization has proved very satisfactory; potatoes have proved especially good for this purpose. The application of sodium nitrate about the time the buds are starting into growth was found to be of value in increasing the crop. Neither lime nor phosphorus alone exerted any appreciable influence. Fertilization of any kind appeared to have no effect on improving the color of the fruit, nitrogen apparently having more of a tendency to reduce it.

A study of *Azotobacter* as related to ammonification and nitrification shows the power of the nitrifying organisms to react under such a wide range of conditions that if the environment is favorable for the rapid reproduction of the organisms ordinary variations of farm practice exert no appreciable effect.

Thirty-five years' work with fertilizers on a five-year rotation of corn, oats, wheat, mixed clover, and timothy hay have yielded some important lessons to Pennsylvania agriculture, and the plats are being given more intensive study with a view to establishing relations between cause and effect. In the absence of manure or fertilizers of any kind, the soil has declined 40 per cent in fertility. Phosphoric acid proved to be the limiting factor in this soil. Potash alone has given no marked increase in the yield, but combined with phosphoric acid it proved to be the most profitable mixture used. Nitrogen alone or with potash had no appreciable effect, but combined with phosphoric acid it produced slight returns. The economy of light applications of manure for general farm crops was clearly shown. Gradual changes in the acidity of the plats are taking place as manifested by the absence of clover on certain plats and the increase in area where clover is failing. The plats that have been treated continuously with dried blood are now showing a scant growth of clover. The mineral matter of ground bone seems to check the formation of acidity to some extent, the same being true of nitrate of soda. Heavy cropping removes large amounts of mineral matter and tends to increase acidity. Crushed limestone, all of which will pass through a screen having 10 meshes to the linear inch, is satisfactory. High calcium and high magnesium limestones were found to be about equally effective. Rock phosphate alone had very little effect on corn and clover, but when used with organic matter it gave results equal to acid phosphate containing about one-third as much phosphorus.

Work with Hatch and other funds.—A study of the relative merits of different grass mixtures for pastures has shown that aside from

Kentucky blue grass, redtop has secured the fullest possession of the land. Planting potato peeling gave a yield of 31.5 bushels per acre; eyes cut with a conical piece yielded 78.3 bushels; and seed cut in the usual way, 152 bushels. Seed dug slightly immature gave a gain over seed of the same variety allowed to fully mature. Seed stored in a cave and kept dormant until planting time outyielded seed stored in a warm cellar, but the chilling of seed potatoes affected the yield adversely. Sun sprouting before planting did not increase the yield. The range in yield of varieties tested was from a minimum of 63 bushels to a maximum of 212 bushels per acre. A trial of sweet clover as a forage crop showed that where lime was applied it reseeded itself, while on the unlimed portion it is drying out. A study of the lime requirements of Pennsylvania soils shows that the Volusia, Upshur, Lackawanna, and DeKalb soils require about 5,000 pounds per acre, while the Hagerstown, Chester, Penn, Westmoreland and Berks soils, which are among the most fertile in the State, require only about half this amount.

Among the points brought out in studying the maintenance of breeding ewes of mutton and wool sheep were that corn silage as a sole roughage supplemented with 1 pound of cottonseed meal to each 25 pounds of silage was an unsatisfactory ration for pregnant ewes. A ration of alfalfa hay, corn silage, and a limited grain mixture was satisfactory. A comparison of Shropshire and Delaine Merino ewes showed that the Shropshire produced a higher percentage of lambs which were heavier, made a more rapid growth, and matured earlier. The Delaine Merinos did better on pasture without supplementary feeds, required less grain through the winter, and cost less for maintenance.

The results of steer-feeding experiments showed a marked advantage in favor of silage in feeding beef cattle. Animals receiving this with no corn except that in the silage made an average daily gain of 2.08 pounds per head during the entire period of 140 days. Cattle fed a heavy silage ration sold for a higher price than those receiving corn in addition to a limited silage ration during the latter part of the feeding period, or in addition to mixed hay and corn stover or shock corn and mixed hay. Wheat bran at \$25 per ton was not found to be as desirable a source of protein as cottonseed meal at \$32.66 or alfalfa hay at \$15 per ton. A comparison of alfalfa hay and cottonseed meal as a source of protein fed with corn silage and supplemented with corn, showed the superiority of cottonseed meal in producing a more rapid finish. Young breeding stock was wintered on corn silage as a sole roughage supplemented with cottonseed meal at the rate of 3 pounds per 1,000 pounds of live weight daily. In summer all steers were maintained on pasture without grain.

Swine-fattening experiments to compare the value of different nitrogenous supplements to corn and the effect of different methods of preparing corn on the gains made showed the most rapid gain with these animals fed corn meal and tankage. Feeding shelled or ear corn produced nearly the same average daily gains, but the cost was slightly higher in the lot fed shelled corn. The cost of maintaining brood sows from the time of breeding until farrowing was tried, the cheapest being alfalfa hay, costing for the 114 days of gestation \$5.69.

The dairy herd had to be built up with fresh stock owing to the tuberculous condition of the old herd. Large quantities of corn stover are used in the State for bedding and as feed, and a trial was made to see if this could not be ensiled to better advantage. It was found that it could be cut readily with a silage cutter and if an amount of water equal to three times the weight of the dry stover was added at the time of filling the cattle ate it with apparent relish and consumed more of it than the dry fodder. Chemical and bacteriological tests were practically the same as with ordinary corn silage. In a test to compare silage alone with silage and mixed hay as a roughage for dairy cows, it was found that while silage can be fed alone for a short time without detrimental effect on the health of the cow or serious decrease in milk flow, there is an advantage in supplementing the silage with hay. Three years' comparison of open-shed housing with temperatures ranging from 0 to 40° F. as compared with closed stabling with temperatures from 40° to 50°, showed that both groups decreased in production during very cold weather, the outdoor group decreasing more but regaining the normal production sooner. The indoor group produced 2,656 pounds of milk as compared with 2,443 pounds by the outdoor group. In studies on veal production the calves were fed during a period of 53 days, receiving whole milk. The amount of milk required to produce 1 pound of gain was 9.4 pounds. The average daily gain was 1.85 pounds. The return above feed cost was \$1.51 per calf.

In the horticultural department experiments have shown that it is possible and desirable for the commercial gardener to grow his own cabbage seed as he can use greater care in the selection of plants. Some breeding work with tomatoes has been carried on. When selecting seed, fruit should be chosen only from those plants producing a large percentage of desirable fruit rather than superior fruit from poor plants. The effect of the size of asparagus crowns at the time of planting on the yield showed that the smaller crowns did not yield as well as the larger ones, the difference being about \$100 per acre.

Complaints from certain tobacco sections regarding lack of whiteness in the ash and poor burning quality of the leaf were investigated

and the trouble was found to be largely due to the exclusive use of barnyard manure. When from 250 to 300 pounds of a mixture supplying potash and phosphoric acid was applied per acre the trouble was eliminated and the increase in crop paid for the fertilizer. It has been demonstrated that these two elements must be furnished in sufficient quantity to secure proper burning quality.

The botany department is securing information in regard to the weeds occurring in the State and will study methods of control. Studies on plant diseases have included the club root of cabbage, winter blight of tomatoes, blister rust of pines, fruit spot of the apple, shothole disease of stone fruits, peach leaf curl, and pear diseases.

The forestry department has been making observations on the lasting quality of various woods and the value of creosoting, also the relative value of different kinds of nails for shingling. Shingles of redwood, red cedar, and chestnut, and creosoted shingles of chestnut, southern yellow pine, and pitch pine were laid nine years ago. Examination at this time shows no difference in lasting qualities. Creosoted shingles of pitch pine, a most perishable wood, have lasted as well as the most durable varieties. The treatment with creosote costs about 50 cents per bundle. Chestnut fence posts were creosoted and set 10 years ago with check posts. Examination shows that the treated posts are all in good condition, while the check posts are badly rotted. Studies have been made of the moisture content of wood allowable for inside and outside work.

The following publications were received from this station during the year: Bulletins 141, Cultural Methods in Bearing Orchards; 142, Net Energy Values for Ruminants; 143, Computation of Dairy Rations; 144, The Maintenance of Breeding Ewes of Mutton and Wool Sheep; and 145, Steer Feeding Experiments.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15,000.00
United States appropriation, Adams Act-----	15,000.00
Fees -----	7,100.36
Sales-----	22,029.96
Miscellaneous -----	4,336.50
Total -----	63,466.82

The Pennsylvania station, as indicated by the number and kind of projects pursued, maintained a wide scope of activities and deals with numerous technical and other agricultural problems of the State. Its advance in the solution of many important agricultural questions is resulting in increased interest on the part of the farming population. The station is in need of more financial aid from the State.

The Pennsylvania State College Institute of Animal Nutrition, *State College.*

H. P. ARMSBY, PH. D., LL. D., *Director.*

The work of the year has been largely along the line of improving, repairing, and increasing the laboratory equipment, bringing the analytical work up to date, and making the required computations. The loss of two trained men who entered the Army caused considerable delay in the work. The discovery of tuberculosis in the station herd has also interfered with the work of the institute.

The project involving the test of the accuracy of the respiration calorimeter has received considerable attention. A modification of the temperature difference recorder has been completed and installed.

The only other project under active investigation was the study of methods for determining with the respiration calorimeter the oxygen consumption and carbon dioxid elimination of an animal. A method for determining the oxygen consumption based upon a gravimetric determination of the oxygen of the outgoing air has been worked out, and, while some details remain to be perfected, it is believed that the method is a practicable one. It will be put into active use during the coming year. An apparatus for the frequent determination of the carbon dioxid content of the outgoing air has been constructed but is not yet in use.

The investigation on the partition of nitrogen in the urine of cows was interrupted by the departure of a member of the staff who was carrying it on.

As will be seen, the year was mainly one of preparation for future work by the installation of new and improved apparatus. This promises a continuation of the high grade of work along lines which make the institution unique in its activities.

PORTO RICO.

Porto Rico Agricultural Experiment Station.

D. W. MAY, M. Agr., *Agronomist in Charge.*

The lines of work of the Porto Rico station have been continued about as formerly, but during the latter part of the fiscal year an especial effort was made to reach the farmers and others in an attempt to stimulate food production. The station had data accumulated from more than 15 years' experiments with all sorts of economic plants upon which to base its recommendations. In cooperation with the insular food commission, an active campaign was inaugurated for greater local production of foods, and as a result the output of many important crops has been largely increased. The island annually imported \$800,000 worth of beans, but as a result of the emergency work enough beans were produced to supply all local needs and to leave a surplus for export.

Since the last report was made, H. E. Thomas was appointed assistant plant pathologist and W. P. Snyder plant breeder of the station. H. C. Henricksen, formerly with the station as horticulturist, and W. A. Mace, transferred from the Bureau of Agriculture, Philippine Islands, were appointed to develop the cooperative and demonstration work and to act as advisers of farmers, horticulturists, etc. The station has just begun cooperative experiments in rice growing, the work being taken up with the Office of Cereal Investigations of the United States Department of Agriculture and with planters in various parts of the island.

The chemical department of the station has devoted a considerable portion of its time and energy to a study of the efficiency of various forms of phosphates when applied to Porto Rican soils, the work involving investigations of the forms in which the phosphorus occurs, the effect of liming, and the rate at which the phosphoric acid becomes available. These data have been accumulated for three prominent soil types and they will be extended to include four others, more than 200 pots being employed for each soil type. The studies on lime-induced chlorosis have been continued, as have those on the relative efficiency of sulphate of ammonia and nitrate of soda for rice and the absorption of nutrients by the roots of plants. Considerable attention has been given chlorosis of sugar cane, certain regions of the island having been found suffering from this trouble. A survey has been made of the soils on which chlorotic cane is produced, ash analyses of cane made, and control experiments inaugurated. Chlorosis in this case is considered to be due to a lack of iron in the plants resulting from a depression in the assimilation of iron by the plants caused by the presence in the soil of carbonate of lime.

The horticultural department of the station has reported on experiments with sweet potatoes, comparative tests of Porto Rican and mainland types having been made. A number of East Indian seedling mangoes have been brought into fruit, thus permitting a comparison with each other and with the parent plants. The results indicate that seed can not be used in propagating most of the varieties tested. Some work in the fertilizer requirements of citrus fruits is in progress. The coffee work has been somewhat extended, and it now includes studies of soils, fertilizers, cultivation, varieties, etc. A cacao plantation made in 1903 is coming into good bearing condition. The experiments with vanilla are being considerably extended, data having been secured on vine growth, fertilization, effect of foreign pollen on vanilla, curing, etc. Quotations of \$4 per pound were received on some samples.

The plant pathologist has made studies of diseases affecting vegetables, citrus trees and fruits, and vanilla. The vegetable diseases are

mostly those common on the mainland, and so far as tests were made they were found to yield to the same treatments as have been employed on the mainland. Withertip and scab are considered the most serious citrus diseases in Porto Rico. Some experiments on the control of scab on grapefruit by the application of sulphur in dry form and in several liquid mixtures were conducted without very definite results.

The entomologist has completed his studies on the changa and means for its control and has begun an investigation of the cattle tick. A dipping vat has been constructed for the station, and the effect of the dip solution on engorged ticks has been studied, as well as their egg-laying habits under varying conditions of weather, shelter, etc. A new corn pest, an undetermined phorid fly, has been reported as injurious to corn through its destruction of the silk.

Plant-breeding work has just been taken up in a systematic manner, attention being given to varieties of wheat from India, oats, corn, beans, okra, sweet potatoes, etc.

The publications received from this station during the year were as follows: Bulletins 17 (Spanish edition), *Enfermedades del Cafe Causadas por Hongos en Puerto Rico*; 18 (Spanish edition), *Experimentos con Abono en Árboles del Género Citrus en Puerto Rico*; 20, *Experiments on the Supposed Deterioration of Varieties of Vegetables in Porto Rico, with Suggestions for Seed Preservation*; 21, *Some Profitable and Unprofitable Coffee Lands*; and the Annual Report for 1915.

The income of the station during the past fiscal year was as follows:

United States appropriation	\$40,000.00
Sales	753.41
Miscellaneous	1,313.69
Total	42,067.10

The continued efforts of the Porto Rico station to meet the agricultural needs of the island are increasing the production of all staples, placing larger quantities of Porto Rico products on our markets, and reducing the insular import requirements.

RHODE ISLAND.

Rhode Island Agricultural Experiment Station, *Kingston*.

B. L. HARTWELL, Ph. D., *Director*.

The station has continued its work along the lines in which it has been engaged for several years, mainly on soil and crop studies and poultry investigations. There has been no serious interruption in the work, changes in the staff being confined to the assistants, two of

whom left for military service. The station receives no State aid, and is dependent wholly on the Federal appropriations and sales receipts. It has charge of the State inspection of feeds and fertilizers, for which it is paid.

Adams fund projects.—Studies on the comparative requirements of plants for calcium and magnesium were carried on by plat tests with various plants, this year sugar beets, beans, onions, and endive being grown in one series, and barley, carrots, alfalfa, and beets in another. The different plats have received magnesium hydrate, magnesium carbonate, calcium carbonate, and calcium hydrate followed by an application of magnesium potassium sulphate. Beets and onions did much better where the alkaline material was added, while beans seemed to thrive equally as well on an acid soil. Although these applications have been made for several years the soils are still acid. There is thought to be little danger of adding too much magnesium. With most crops it is believed that complete neutralization is not necessary as they appear to do as well in the presence of slight acidity.

Investigations on soil acidity have been carried out both in the field and by pot cultures. A part of the injurious effects ascribed to acid soils is believed to be due to the presence of aluminum salts in the soil solution, and much of the benefit derived from liming the soil is thought due to the precipitation of the aluminum compounds. Plants grown in solution with different amounts of aluminum show much the same effects as those growing in acid soils. Alumina is much more toxic to barley than to rye, which corresponds to the effect on so-called acid soils. The use of a high magnesium limestone, as compared with a high calcium limestone, indicated no reason for avoiding magnesium compounds. By the continued use of ammonium sulphate in place of sodium nitrate as a top-dressing for lawns, soil acidity has been maintained to such an extent that weeds were eliminated, particularly crab grass. Pot experiments showed Thomas slag to be about one-third as efficient as a neutralizer as calcium carbonate.

Other projects that have received some attention during the year relate to the amount and solubility of the nitrogen in seed potatoes as affecting their viability, on the nutrient requirements of the carnation, which were determined, and a study of the influence exerted upon plants by the previous growth of other plants. The latter point has been studied both in the field and in the greenhouse with very striking results in some cases, which are believed to be due to the effect of the different crops on the soil acidity. As an example of this, it was found that alsike clover following alsike, red clover, or carrots gave a poor yield, while good yields were secured following rye, redtop, and squashes. Many combinations have been tried with some interesting results.

Investigations on the physiological effect and relationship of nutrient elements on plant growth were conducted in the greenhouse, oats being grown from seed to maturity in solutions under suboptimum, optimum, and maximum rates of nutrition. At present the work is mainly on potash and phosphorus requirements.

Poultry investigations have long held a place in the station work. Among other subjects claiming attention is the blackhead disease of poultry. Observations have led to the belief that it is induced by improper feeding. The parasites that were supposed to be responsible for it can be found in healthy birds and seem always to be normally present, both in healthy and diseased fowls. The laboratory work has related to the means by which the birds first become infected, what part of the tissue is affected, and how the tissues come to be invaded. The parasites are found to be always present in small numbers in the intestinal tract, ordinarily presenting no menace to the health of the birds. Unfavorable conditions, as improper feeding or chilling, cause diarrhea and the parasites then multiply rapidly, invade the deep crypts, and begin to break through and invade the tissues through the goblet cells. The diarrheal condition must be avoided to prevent the disease becoming serious.

Fowl-cholera studies have led to the belief that it may be due to at least three and possibly four organisms, one identical with *Bacillus coli*, a second related to the paracolons, including the hog-cholera bacillus or food-poisoning bacteria, and a third group producing a choleralike infection sometimes called fowl typhoid. The agglutination test has enabled the separating of the bacterial entities into groups. A study of the bacterial infection of eggs has been made to determine if diseases may be thus transmitted. Birds were experimentally infected with different cultures of the organisms which play a part in poultry diseases, but only in rare cases were the organisms found in the eggs produced. Tests as to the germicidal action of normal albumen were negative. Agglutination tests with the albumen of immune birds gave no reaction.

Inheritance studies with poultry have been carried on along various lines. Strains have been bred in which the quality of laying large or small eggs has become firmly fixed as an independent inheritable character. Data have been secured demonstrating the presence of factors in black pigmentation in the White Dorking breed of fowls, which is obscured by the inhibitory factor carried by the dominant white races of poultry. Studies on immunity inheritance are in progress.

Work with Hatch and other funds.—Variety tests with the Irish potato show that the Green Mountain is best suited to the locality. Uncut seed on which the buds or sprouts were allowed to form before

planting produced 304 bushels of marketable tubers as compared with 242 bushels when not budded.

Pot experiments on the efficiency of manures showed the insoluble nitrogen in certain brands of fertilizer to be practically useless and the nitrogen of tankage was found to be of low grade. The after effects of different forms of phosphate on the hay crop showed no difference when the same amount of money had been invested in raw rock phosphate or acid phosphate, or whether an amount of phosphoric acid equal to that in acid phosphate was applied as bone, Thomas slag, or double superphosphate. Mixed timothy and clovers sown the preceding year in silage corn yielded about 3.5 tons of hay regardless of whether they were top-dressed with fertilizer chemicals or with 4 cords of cow manure. In a trial of American rock potash prepared under the auspices of the United States Department of Agriculture by fusing ground feldspar with calcium chlorid, compared with potassium sulphate on the basis of water-soluble potash, the former yielded a slightly larger crop of potatoes. Two tons of wood ashes per acre applied as the source of potash to potatoes produced a very scabby crop, owing to the alkalinity of the ashes. Raw muck compared with stable manure, each supplying an equal amount of organic matter in connection with fertilizer chemicals, proved inferior. When the muck was composted with hydrated lime at the rate of 10 cords of muck to 1 ton of lime, quite satisfactory results were obtained. Twice as large a yield of beans was obtained where stable manure instead of fertilizer chemicals had been used continuously, demonstrating that when the ground is used each year for market garden crops and no special provision is made for the introduction of organic matter, success can not continue. Grass on soil from which potash had been withheld sufficiently so that only half a crop was obtained, was increased one-third by the addition of 240 pounds of salt per acre. It was found that only where the soil is deficient in available potash salt may prove a useful substitute.

Variety tests of soy beans for silage were carried on, Wilson giving the largest yield of 261 pounds. With variety tests of Irish potatoes Cuban Multiplier, Pride of Vermont, Gold Coin, and Lowell Green Mountain all yielded over 300 bushels of marketable tubers per acre.

The following publications were received from this station during the year: Bulletins 165, Starch Congestion Accompanying Certain Factors Which Retard Plant Growth; 166, The Rôle of the Flagellated Protozoa in Infective Processes of the Intestines and Liver; 167, A Twenty-year Comparison of Different Rotations of Corn, Potatoes, Rye, and Grass; 168, The Avenue and Development of Tissue Infection in Intestinal Trichomoniasis; 169, Studies by Means of Both Pot and Solution Culture of the Phosphorus and Potassium Requirements of the Barley Plant During Its Different Periods of

Growth; 169, Supplement, Publications of the Work of the Agricultural Experiment Station of the Rhode Island State College, Kingston, R. I.; 170, The Persistence of Lawn and Other Grasses as Influenced Especially by the Effect of Manures on the Degree of Soil Acidity; and Inspection Bulletin, October, 1916, Analyses of Commercial Fertilizers.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
Miscellaneous, including balance from previous year..	7,304.86
Total	37,304.86

The station is continuing its work along lines established several years ago, and is directing its attention to some of the fundamental questions involved in the maintenance of fertility and the handling of poultry.

SOUTH CAROLINA.

South Carolina Agricultural Experiment Station, *Clemson College*.

H. W. BARRE, M. A., *Director*.

A change in directors and in organization of the agricultural work occurred during the year. J. N. Harper, who had been dean and director since 1905, resigned, C. C. Newman serving as acting director until April, 1917, when H. W. Barre was appointed, and the directorship was separated from the office of dean of agriculture. Aside from this there were no important changes in the staff or its general conduct.

Adams fund projects.—A study of a method for the rapid and accurate determination of potash in mixed fertilizers was made and a process found which greatly shortens the time involved in making the analysis and utilizes porcelain dishes instead of platinum for ignition. Cylinders with different soil types have been planted with beets, sorghum, and sweet corn to study the influence of soil type on the sugar content.

Work has been begun on potatoes to determine the factors influencing seed production, in connection with which crosses of various varieties on Lookout Mountain are being made to secure a better potato for the South, as this variety lacks in mealiness. It produces seed abundantly and will thus offer opportunities for breeding new varieties.

The project on the influence of temperature and moisture on insect activity is being carried on with a specially devised apparatus which controls temperature and moisture very accurately. One of the

rooms was run continuously night and day for $7\frac{1}{2}$ months, with a variation of not more than $\frac{1}{2}^{\circ}$ F. A special apparatus can be attached to the body of the insect which shows its temperature. This is used as a guide in determining the "critical" temperature for insects. This is supposed to be fixed by the coagulation of albumin in the insect body. The fatal temperature is dependent on the temperature of the organ of the body that is most active. At present the corn weevil and harlequin cabbage bug are being studied. Field records have been obtained bearing on the correlation between the climatic conditions and seasonal outbreaks of insects. It was found that wireworms may be readily controlled by means of the moisture content of the soil. They were found to be scarce when the moisture was 12 per cent and all gone at 14 per cent. Any means by which this percentage of moisture can be reached and maintained will effectively stop their action. This is done in the coast country by putting on humus from swamps.

Two kinds of barren cornstalks have been found, one due to environment which is not transmitted and another which is an inherited and transmitted barrenness. The latter grow taller and larger round and are thus easily recognized. The origin is not known.

A study of cotton anthracnose has shown that the fungus practically all died after three years. If the disease is confined to the outside of the seed treatment with sulphuric acid is effective. When it occurs on the inside hot water is used. The persistence of the disease evidently depends on the conditions under which the seed is kept. Desiccation appears to be the means by which the fungus is killed out. Efforts are now being made to grow disease-free seed, for which purpose it must be grown on soil that has not been in cotton for at least two years.

The cause of the shedding of squares and young bolls of cotton has been studied, both in pots and in the field, with records of soil moisture and meteorological data. The relation of soil moisture, transpiration, leaf area, and water requirements to shedding is being investigated, also the influence of soil moisture and atmospheric humidity on stomatal development. It requires from one-fourth to one-third more water to produce cotton on a poor soil than on a fertile one. About a third of the total requirement is used during the month of August and as much is required in September as in July, showing the inadvisability of stopping cultivation during that month. Some correlation has been established between drought resistance and leaf area.

The angular leaf spot of cotton, which is widespread, is being studied as to the cultural characters and life history of the organism causing it, and the way in which it survives the winter. It is believed

to be practically confined to the seed and appears to be on the interior rather than on the surface. The under side of the smaller leaves are the most susceptible. Some important results were obtained from observations on the dissemination of this disease, which is apparently due to splashing during rainstorms accompanied by wind. Studies in the laboratory showed that a raindrop falling on a wet surface may scatter droplets fully 18 feet away if a little wind is blowing. This may explain the dissemination of other diseases such as citrus canker after rain. Insects appeared to have no marked connection with its spread. Studies have been made of a species of *Alternaria* which seems to follow angular leaf spot and causes considerable damage to cotton leaves.

Work with Hatch and other funds.—Chemical studies of soil fertility have demonstrated that the returns from the use of potash on corn and oats are not sufficient to make it profitable on these crops anywhere in the State. In the Piedmont region it appeared to injure rather than help cotton, but at the coast station it was of some benefit.

The horticultural department has made extensive variety and fertilizer tests with peaches, apples, grapes, plums, and a large number of vegetables. Growers have considerable trouble in getting lettuce to head. The remedy for this has been studied in the greenhouse. Potash on sandy and clay soils not only did not remedy the difficulty but appeared to be injurious, while acid phosphate and barnyard manure produced good heading. The yield from male asparagus plants was found to be about twice as heavy as that from female plants.

An outbreak of the cottony cushion scale near Charleston was apparently completely checked by the introduction of the Australian lady beetle which was obtained from Florida. Funds have been provided by the college and the Crop Pest Commission to follow up the spread of the boll weevil in the State and to make studies relative to its dissemination.

Extensive trials have been made to work out a rotation of crops for pasturing hogs. A large variety of crops is being used for this, including corn and velvet beans, corn and soy beans, corn and cowpeas, peanuts, sweet potatoes, cabbage, Abruzzi rye, wheat, barley, oats, rape, and crimson, bur, and red clover. Rape, rye, and clover have given fine results when fed with a small amount of concentrates. Comparing velvet-bean meal and soy-bean meal for hogs, the former has so far given the best results and was better relished by the hogs.

A comparison of velvet-bean meal and cottonseed meal as feeds for dairy cattle showed a slightly better milk flow from cottonseed meal and a somewhat softer and whiter butter was produced by the velvet-bean meal. An attempt is being made to develop the barrel of

heifer calves by feeding more roughage than usual, using silage, pea vine hay, and a mixture of the two. Studies to determine the cause of the gummy body common to southern butter are under way, the melting point, iodine, and saponification number of the butter made from cows fed from the various feeds commonly used being determined. Some horse-breeding work for mule production is carried on mainly as a demonstration.

The agronomy department is making variety tests of cotton, corn, wheat, oats, and soy beans, especially with newer varieties, and is doing some selection work with Cook and Cleveland cotton, corn, and small grains.

The botanical department is successfully breeding wilt-resistant varieties of cotton and cowpeas and a large amount of seed has been distributed to farmers who have experienced losses from these diseases. This work is developing rapidly and appears to be much appreciated throughout the State.

The following publications were received from this station during the year: Bulletins 184, Angular Leaf Spot of Cotton; 187, Analyses of Commercial Fertilizers; 188, A New, Rapid, and Accurate Method for Estimating Lime and Potash in Soils; 189, Cotton—Varieties and Limiting Factor Tests, 1916; 190, Corn—Varieties and Limiting Factor Tests, Season 1916; and the Annual Report for 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation.....	7,154.41
Farm products, including balance from previous year..	2,417.20
Total.....	39,571.61

The South Carolina station is conducting a large amount of experimental work of importance to the agriculture of the State. It is receiving constantly growing appreciation from the farmers who are taking more and more advantage of its work.

SOUTH DAKOTA.

South Dakota Agricultural Experiment Station, *Brookings*.

J. W. WILSON, M. S. A., *Director*.

The South Dakota station is in a flourishing condition and is accomplishing a large amount of valuable work. For the first time it received a direct appropriation from the State, this being in the form of a revolving fund of \$5,000 for the purchase of live stock for breeding experiments, and one was made to the institution of \$10,000 for the purchase of pure-bred live stock for instruction, demonstration, and experimental purposes. These funds will be used largely for

conducting feeding experiments with cattle and sheep. The agricultural college received liberal appropriations which will more or less indirectly benefit the station. These included \$100,000 for an addition to the agricultural building and \$20,000 for a stock-judging pavilion. A special appropriation of \$2,000 per annum for two years was made for the study of hardy alfalfas. No important changes were made in the staff and no new station buildings were erected during the year.

Adams fund projects.—A study of the influence of rotations upon the maintenance of soil fertility is now in its sixth year. This is conducted on 112 plats, various systems of rotation being tried, and the yield of crops, the effect on the soil, and the effect of various fertilizers singly and in combination are noted.

An investigation of plant correlation as affecting yielding capacity, wheat being mainly used, at first indicated a positive correlation between greater length of mother head and yield of progeny. This, however, has not been borne out by later observations. A project on water as a limiting factor on the growth of sweet clover is being carried on in pots which are protected and under control. These have received water to the amount of 9, 11, and 13 per cent of saturation, three types of soil being used in each series. Marked variation has been noted in the habit of growth as influenced by type of soil and water content.

The dairy husbandry department has made an exhaustive study of the rôle of water in the ration of the dairy cow. About 12 per cent of the water drunk is eliminated through the skin during the winter under barn conditions and about 27 per cent during August, with the accompanying body waste matter. Fifty-six per cent of the water taken in was eliminated in the feces and about 13 per cent passed through the kidneys in the form of urine. The water that is eliminated by the organs of the body first enters into the circulatory system of the animal and there plays the part of a distributing agent. The amount used for milk production averaged about 15 per cent of the water drunk. One cow with a large milk production used 24 per cent for this purpose. In addition to the water drunk there is a certain amount produced by the metabolic changes of the food. In the animals under investigation this was found to average 27 pounds. The amount drunk averaged 75 pounds, making 102 pounds of water supplied to the body daily, in addition to the amount consumed in the food.

A study of the relative value of the proteins in different feeds for supplying the needs of dairy cows has this year been mainly on oil meal. Cows fed a ration deficient in protein, consisting of wild hay and silage, required a daily addition of 5.5 pounds of oil meal to

maintain a nitrogen balance. Other high protein feeds will be compared in the same way.

A project on the digestibility of grains and fodders by horses, which has been in progress for some years, was completed. Autopsy of a horse that had been fed oat straw alone for several years showed an almost complete absorption of the cartilage of the joints, leaving the articulating surfaces bare and rough, the animal evidently drawing on its own body for nitrogen in endeavoring to maintain the nitrogen balance.

The department of horticulture has actively carried on work in the improvement of hardy fruits for the Northwest by breeding and crossing. A number of new varieties are on trial this year. Seedlings were obtained from the Manitoba wild plum, which on account of their hardiness, small size of trees, and very early fruiting were valuable. These were improved by crossing with choice plums from California and some excellent results have been obtained. These have been named after the Indian tribes of the North, and the Ojibwa, Cree, and Pembina are now offered for the first time, and are very promising. Seedlings from the sand plum of Kansas crossed with the Wolf plum have produced two hybrids of excellent quality, the Kaw and Kiowa, which are recommended for the southern portion of the State. A seedling cherry from the vicinity of Moscow, Russia, budded on Mahaleb roots has proved an excellent bearer of good quality and hardy for the prairie Northwest, and will undoubtedly prove a valuable addition to the fruits for this region.

The greatest enemy to the pear industry is the blight, which has been exceptionally severe during the last three years. This has offered an opportunity to study resistance, which has proved quite successful, especially with a Siberian and a Japanese variety. These have been developed further and crosses made to improve them, and it is believed that a practically resistant stock has been found which requires only some improvement as to hardiness. A wild pear from the Pacific Coast of Siberia will probably be the hardy, blight-proof stock of the future. An excellent, large, wild crab apple, the fruit of which is about 3 inches in diameter, has been grown for distribution. The original tree of this variety was found growing wild in Illinois. It will be used mainly for making jelly. A new, red Siberian crab, the Dolgo, was also found to be a vigorous producer, free from blight, and of most excellent quality. The department is now developing a hardy winter apple for the prairie Northwest, the demand for which is very great.

The wheat-stem maggot caused about 15 per cent loss in some localities. Its life history, wild and cultivated host plants, and methods of control are being studied. Parasites hold it well in check in some seasons, which suggests a method of control which will be

developed. Arsenical sprays and dusts were found most satisfactory for the control of the spinning sawfly of the plum. The part played by the stable fly in its relation to anthrax and other diseases and its importance to the dairy industry has led to a study of its dissemination, life history, and the various materials chosen by the fly for breeding purposes.

Work with Hatch and other funds.—Various field rotations to determine the relative values of close and broad systems from the standpoint of production are under investigation and indicate that many problems in this connection still remain to be solved. Breeding corn for high protein and the possible correlation of a high percentage of protein in the seed with a high yield of protein per acre, is being studied.

Systems of farm management to produce the greatest amount of available food is a timely subject under investigation at present. A comparison of the live stock and the grain systems of farming when conducted for a sufficient number of years will, it is hoped, determine whether the apparent advantage of returning crop residues to land in form of barnyard manure is ultimately offset by the decomposition of crop residues directly in the soil.

The animal husbandry division is studying the relative feeding value of corn silage made from corn cut in the milk stage, the dough stage, when the ears are glazed, and after a heavy frost. The relative value of different supplements for hogs on forage is being studied and is yielding valuable data. Sheep-breeding experiments to develop a hardier breed suited to conditions of the Northwest are proving successful. One of the characteristics desired is a strain that does not need docking. By breeding half-blood Siberian ewes to half-blood Siberian rams, three lambs with miniature tails were secured, with which it is hoped to develop such a strain. The wool from some of the crosses already made has been judged by experts to be equal in value to that of the best Downs sheep.

The development of improved sugar beet by selection has been very successful and plantings have been made on a commercial scale.

Investigations on the production and storage of ice on the farm have been made with different sized blocks. When made under directions previously given it is found that the cakes bulge when freezing and thus do not pack well. Different methods of keeping ice have been tried and records of the amounts of ice stored and used are kept. Nine different milking machines have been on trial. It is found that cows do better when their use is begun shortly after the cow freshens and is continued through the lactation period. Most cows are readily milked by machine but some, of a nervous disposition, never become used to it. The effect on the udder, on the total

quantity of milk during the milking period, and on the length of the lactation period is being studied.

An experiment is in progress to determine the number of feed units produced per acre, using various crops and combinations of crops. Thus far corn and alfalfa have given the best results. For grasshopper control white arsenic was found to be not quite as efficient as Paris green, but on account of the high price of the latter white arsenic is being substituted for it.

The horticultural department has been doing much work with new berries, garden truck, ornamentals, and alfalfa for South Dakota conditions. A variety of raspberry has been developed which is entirely hardy in the State. Some hardy alfalfas which have been produced at the station have been widely distributed over the State. This is supported by special appropriation. A number of fine rose hybrids have been developed worthy of further propagation.

As emergency work attention is being given to proso or white millet, which is extensively used for food in Russia. Bengal beans, several tons of which were shipped into the State, were investigated as they contain a glucosid yielding hydrocyanic acid. Analysis of some samples showed 0.043 per cent of this acid, which is dangerously high, and a warning was issued regarding them.

The following publications were received from this station during the year: Bulletins 165, Corn Silage for Lambs; 166, Important Factors Affecting Machine Milking; 167, Transplanting Alfalfa; 168, Breakfast Foods and Their Relative Value; 169, Flax Culture in South Dakota; 170, Characteristics of Quack Grass (*Agropyron repens*) and Western Wheat Grass (*A. occidentale*), with Special Emphasis on the Eradication of Quack Grass; 171, Pasteurization of Cream; 172, Grasshoppers and Their Control; Index, Bulletins Nos. 1-163; and the Annual Report for 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation, including balance from previous year	12,202.00
Farm products, including balance from previous year..	6,936.65
Miscellaneous, including balance from previous year..	10,211.11
Total	59,349.76

The station is gaining in the confidence and appreciation of the people of the State and has been of great practical benefit to agriculture. With continued and increased State support the station will be able to prosecute its investigations more extensively and the results will be more quickly available for distribution.

TENNESSEE.

Tennessee Agricultural Experiment Station, Knoxville.

H. A. MORGAN, B. S. A., *Director*.

The outlook for the future for the Tennessee station is exceptionally favorable, provision having been made by the last legislature by which \$1,000,000 becomes available for the University of Tennessee and the experiment station. In addition to this a half-mill tax is to be levied, a portion of this being available for the use of the station. From these funds \$100,000 is to be used for the establishment of a middle Tennessee station in Murray County, the county to provide the farm. Ten thousand dollars will be used for building on the recently acquired land at the central station. The Middle and West Tennessee stations are to receive \$10,000 each yearly for maintenance.

The station has been carrying a large amount of work since the war broke out. The dean and director was appointed food administrator, and prior to that was prominent in the State council of defense. The work of the station was, however, not seriously affected.

Adams' fund projects.—The study of the bacterial decomposition of organic matter in sand cylinders containing cottonseed meal and straw shows that the presence of organic or mineral acids encourages the decomposition. The growth of molds seems to neutralize the acidity. The form of nitrogen in the nodules of legumes is being studied. It is evident that the nitrogen which is taken up in the bacterial cell is converted into protein which must be split up before the plant can make use of it. This appears to be brought about by a proteolytic enzym in the plant juice. This is being studied by placing cultures of the bacteria, killed with toluol, in collodion sacks and immersing these in the plant juice. The enzym dialyzes into the interior of the sack and the proteolytic action is measured by the biuret reaction. Analyses of the nodules in cowpeas and vetch at various stages of growth to detect intermediate or decomposition products have not yielded very definite results as yet. The nitrogen content of the nodules increases up to the time of blooming, from which stage it begins to decrease, especially as the pods begin to form.

In investigations as to the carbon requirements of the *Azotobacter*, sugars, alcohols, esters, and ethers were tried. All of these forms except the ethers seemed to serve equally well as sources of carbon. Both *Azotobacter* and yeasts were tried. The latter will accumulate nitrogen directly from the atmosphere, and in many respects, both morphologically and physiologically, the *Azotobacter* correspond to the yeasts, especially the pseudoyeasts.

Good results have been obtained in developing strains of clover resistant to *Colletotrichum trifolii*, which have been distributed.

Attention is now being given to the method of invasion, which is being studied by means of unicellular algæ, the cell changes of which can be seen under the microscope. The reaction of the host cell to the invading fungus has been studied and there is found to be a movement of the protoplasm of the cell toward the cell wall that is being invaded. Strains of tomatoes strongly resistant to *Fusarium* have been developed, and the quality of the fruit in these has been much improved by selection. Different species of *Fusarium* have been obtained from different localities in the State, and it is believed that new species have been found.

Extensive studies have been carried on for some years on humus and nitrogen. The major conclusions reached from five years of cylinder experiments are that the utilization of nitrogen from different manurial sources varies greatly with different soils, that the nitrogen content of crops grown on different soils may be appreciably influenced by the kind of soil, and that increased crop production results in appreciable conservation of soil nitrogen, which is much greater than can be accounted for by the increase in crop residues. Further, the manurial treatments result in changes in soil nitrogen, due in some instances to the effect of the material applied per se, as in the case of lime, which under bare fallow results in an increased loss of nitrogen, and in others to the conservation brought about by the crop increase. The latter factor may, as in these experiments, more than offset the loss of nitrogen induced per se by liming or nitrating. Only one of the four soils under investigation appeared to get appreciable quantities of nitrogen from the atmosphere, the soil supply showing little diminution in the five-year period under continuous cropping in nonlegumes.

Some interesting results in the leaching of nitrates have been reached. Lysimeters 1, 2, 4, and 6 feet in depth were used containing different fertilizer mixtures. Nitrate of soda was applied to these and the lysimeters were then subjected to a slow leaching process, 1,000 pounds of water being added eventually to each, the total drainage being collected and analyzed. No crops were grown in the tanks. After one year all of the nitrate added was recovered from the 1 and 2 foot tanks, only 7 per cent from the 4-foot tanks, and none from the 6-foot tanks.

Experiments on the decomposition of calcium and magnesium carbonates in soils, carried on in lysimeters with and without subsoil, showed an excessive disappearance of the magnesia in the drainage waters, the subsoil retaining this much more than it does the lime. The investigation has been extended to study the action of these soil constituents on soil sulphur. Heavy treatments of carbonate of lime and magnesia resulted in a slower conversion of the nonoxygen sulphur compounds to sulphates than did light treatments.

The life history and habits of the hog louse have been worked out. The domestic hog is the only host, away from which the louse can not live over seven days. It occurs over the entire body of the hog, but accumulates mostly in protected parts, as folds of the skin. The eggs are deposited singly at the base of the hairs. The newly-hatched larva reaches maturity in 13 days. It is easily controlled by the application of crude oil.

Valuable results have been obtained by selection experiments with *Lespedeza striata*, both a high, bushy hay type and a grazing type having been developed. One bushel to the acre appears to be the best rate of seeding. Two tons of ground limestone increased the yield 65 per cent the first year, followed by 30 per cent the second year, and 12 per cent the third year.

Attempts to establish a temperature law in crop production have been continued and while a definite relationship between air temperature and plant growth can be established, other conditions enter in, which will be studied.

Work with Hatch and other funds.—The agronomy department has been instrumental in introducing and distributing a variety of corn, "Neal Paymaster," that has become very popular through the State. Some attention was given to the production of early maturing velvet beans when planted with corn and several varieties have been found that mature readily, but it is questionable whether they will prove as profitable as the soy bean. A great deal of variety testing is done with the crops adapted to the State, with many promising results. A study of the root system of trees by excavation to determine the effect of type of soil on the root growth has been under way, also experiments in orchard fertilization. In combating the San Jose scale applications of miscible oil or of lime and sulphur were found to be efficient.

Good success was obtained in storing sweet potatoes in 25-bushel bins having double walls 10 inches apart filled with sawdust poured in but not packed down. The walls were built on a concrete base reaching 1 foot below ground, with an earth floor in the bin. The potatoes kept 12 months in excellent condition.

A comparison was made of northern grown and home grown Irish potatoes for seed. The northern-grown seed gave earlier maturing but higher yields were obtained from the home-grown seed.

The Percheron foundation stud is being used to demonstrate to the farmers of the State the feasibility of producing horses of this type, and also the use of draft mares of this type in the production of mules. The value of velvet-bean meal has been tried with horses, beef and dairy cattle, hogs, and sheep.

The following publications were received from this station during the year: Bulletins 116, How to Feed Live Stock Successfully; and

117, Suggestions for the Control of Injurious Insects and Plant Diseases.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15,000.00
United States appropriation, Adams Act-----	15,000.00
State appropriation-----	23,575.86
Farm products-----	12,040.04
Total-----	65,615.90

The Tennessee station pursued an active and aggressive course during the year and continued to exert a strong influence on agriculture in the State. The interest expressed in the establishment of a permanent station in central Tennessee and the readiness of the people to contribute to it indicate the confidence and following the station has inspired.

TEXAS.

Texas Agricultural Experiment Station, College Station.

B. YOUNGBLOOD, M. S., *Director.*

The station has enjoyed a successful year and satisfactory progress has been made in the various projects under investigation. No important changes were made in the station staff during the year.

The office and laboratory accommodations will soon be extended by the completion of a new three-story station building at a cost of about \$85,000. A residence was built on the station farm for the agronomist and a laboratory and greenhouse added to the equipment of the entomological department, which will greatly facilitate the work. Two laying houses designed to hold from 200 to 250 hens each and a brooder with a capacity of 2,500 chicks were added to the poultry department.

The State appropriations for the main and substations were \$135,000. Twelve substations are closely connected with the central station and form a general system which has proved very satisfactory.

Adams fund projects.—Investigations on sheep and goat diseases prevalent in the State will be greatly aided by the establishment of a substation near Sonora to be devoted entirely to that subject. The chemical department has been making a series of respiration and digestion trials with sheep to determine the productive values of some Texas feeding stuffs, using a new apparatus recently completed.

Numerous crossings have been made between blackberries, dewberries, and raspberries. Most of the hybrids proved to be sterile, but five fertile crosses between the dewberry and raspberry were obtained which produced large, showy, dark red fruits with a very aromatic flavor, that promise to be of value. The raspberry was

dominant in all characters. A hybrid was also obtained between a spineless seedling blackberry and the Early Harvest, with excellent fruit.

A detailed study has been made of the life history and possible food plants of the cotton or melon louse, *Aphis gossypii*. The color is found to vary, some individuals being dark olive, others of a lemon color, and studies in transference to different hosts are being made to determine if this has any relation to the color.

Texas root rot, which seriously affects cotton, sweet potatoes, and other Texas plants, is under investigation and two organisms have been found which seem to bear an important relation to the disease. Interesting results have been obtained from studies of watermelon wilt. Three species of *Fusarium* were isolated which appeared to be the cause of the disease, two of these being new. These three species are not capable of producing the disease on other hosts, and cotton, cowpeas, or okra may be grown on fields that contain these forms without being affected. On the other hand, watermelons may be successfully grown on fields affected with cotton, cowpea, or okra wilt. Blossom-end rot of watermelons also received attention and was found to be caused by three or four organisms, one of which is a *Fusarium* different from those causing the wilt. *Colletotrichum* was also found to be an important source of trouble.

Various points of importance are being worked out in a study of inheritance in cotton. From seed showing a variation of 4 per cent in oil content it was found that this factor is inherited in the progeny. The correlation of high and low oil content to lint is also being studied.

Work with Hatch and other funds.—Studies on the control of crown gall on peach and apple trees are still under way. An attempt is being made to secure a long-lived peach tree by the use of the Indian Cling variety as stock. An orchard for testing fruits is maintained in cooperation with the Office of Foreign Seed and Plant Introduction, of the United States Department of Agriculture.

A feeding experiment on fattening yearling steers was made to compare cold pressed cottonseed meal and ground whole pressed peanuts, using the same basal ration of milo chops, sorghum silage, and Bermuda hay. The results were slightly in favor of the cottonseed meal. The lot receiving this made an average daily gain of 2.24 pounds, while those receiving the peanut meal gained only 2 pounds per day. The peanut meal was not relished as well as the cottonseed meal and more roughage was consumed per pound of gain. In a similar test in fattening 2-year-old steers the results were slightly in favor of the peanut meal. The lot receiving cottonseed meal made an average daily gain of 2.09 pounds, those receiving the peanut meal, of 2.15 pounds. Both lots made an equally good showing on the market.

The cost of feed per hundred pounds of gain for the lot fed cotton-seed meal was \$17.82; for the lot fed peanut meal, \$17.32.

Efforts are being made to develop types of sheep adapted to the range conditions of western Texas, the Rambouillet and Corriedale breeds being used for this purpose. A study of the breeding of caracul sheep is under way, both to produce a fur-bearing breed adapted to Texas conditions and to study the characters with reference to the Mendelian laws of inheritance. Similar studies are being made in Angora goat breeding.

Some important experiments have been made in hardening the flesh of swine fed on peanut pasturage. Packers discriminate against such pork and make a deduction in value, claiming that soft or oily hogs shrink more in the brine and in smoking and that the fresh pork has to be disposed of at a low price. The results showed that pork of hogs grazed on peanuts for 40 days could be hardened so that it was satisfactory to the packers by feeding milo and cotton-seed meal for 30 days or milo alone for 45 days. Various forage crops were tried out in order to secure a succession, the results being quite successful. These included Sudan grass, cowpeas, soy beans, sorghum, and peanuts with barley, wheat, or oats for a winter crop.

The entomological department has been mainly engaged in a study of the harlequin cabbage bug and the cowpea weevil. A mite parasitic on the larvæ of the latter has recently been found. Fumigation with carbon bisulphid for the control of the weevil was not as effective as had been expected. A temperature of 145° F. for 10 minutes kills all stages of the insect and the effect of this temperature on germination will be tested. This department has charge of the enforcement of the State law regulating foul brood in honeybees.

The work in agronomy is carried on largely at the substations, which permits of trials of varieties and strains best suited to the different regions of the State. Satisfactory progress has been made in inbreeding and type study of Kafir corn with promise of valuable results pertaining to the relation between head type and yield. Some extra early and rust proof oats have been secured by selection which are very promising and are being increased.

Fertilizer experiments show that commercial fertilizers will pay profits at the college station and, under similar conditions, elsewhere, only when rotation or other means of increasing the organic content of the soil is practiced. In an attempt to prevent the loss that occurs from recurving of milo heads, which at times amounts to over 60 per cent from the heads being broken off by the wind, it was found that clipping off the top of the leaf sheath allows the head to grow straight and prevents recurving.

Black mold of corn was found to be due to *Aspergillus niger*, which produces a similar black mold in peanuts, cotton, onions, and various other perishable crops when stored without proper drying. The pink rot of the onion, which is causing considerable damage in some sections of the State, is possibly caused by a *Fusarium*, which is very commonly present in cultures made from the diseased parts. Efforts are being made to find means of controlling it.

The department of plant pathology has undertaken, at the request of and in cooperation with some of the railroads of the State, a study of the causes of the rotting of perishable fruits and vegetables in transit. Two diseases of the camphor and a *Septorium* which produces charcoal rot on cactus are also being studied. A plant disease survey of the State is being made in cooperation with the Bureau of Plant Industry, United States Department of Agriculture.

A study of the influence of environment on the length and quality of cotton fiber is being carried out by planting seed from the same source of each of the several standard varieties at the various substations. Trials of depth of plowing with various crops showed that cotton is the only one that will give financial returns from plowing as deep as 12 inches.

Sour skim milk was found to be the most profitable source of protein in feeding poultry. Fowls prefer rations containing some animal feed and make more efficient use of it than those receiving vegetable food exclusively. In a comparison of sour milk, skim milk, cottonseed meal, meat scrap, and peanut meal for egg production, sour milk proved the best and peanut meal the poorest.

The following publications were received from this station during the year: Bulletins 184, Cooperative Fertilizer Experiments with Corn, 1908-1914; 185, The Production Coefficients of Feeds; 187, Sprays and Spraying; 188, Tile Drainage; 198, The Composition of Cottonseed Meal and Cottonseed; 190, The Effect of Additions on the Availability of Soil Potash, and the Preparation of Sugar Humus; 191, The Composition of Rice and Its By-products; 192, Soils of Grayson, Lee, McLennan, Titus, and Tyler Counties; 193, Commercial Fertilizers in 1915-16; 194, Commercial Feeding Stuffs, 1915-16—Texas Feed Law; 195, Japanese Sugar Cane as a Forage Crop; 196, Digestibility of Sugars, Starches, and Pentosans of Roughages; 197, Progress Report of Substation No. 3, Angleton, Texas, 1909-1914; 198, Feeding Baby Bees; 199, Progress Report, Texas Substation No. 6, Denton, Texas, 1909-1914; 201, Peanut Meal and Ground Whole Pressed Peanuts for Hogs; 202, Progress Report of Substation No. 12, Chillicothe, Texas, 1905-1914; Circulars 13, The Green Bug or Spring Grain Aphis; 14, Foul Brood Regulations, Effective On and After September 1, 1916; 15, A Milk House for Texas; 16, Directions for Preparation of Veterinary Specimens for

Examination; 17, The Texas Foul Brood Law and Foul Brood Regulations; 18, The San Jose Scale; and the Annual Report for 1915.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	\$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	135,000.00
Individuals, balance from previous year	141.79
Farm products, including balance from previous year ..	29,667.44
Total	194,809.23

The system of experiment stations in Texas has made a steady growth and is on an efficient basis. The support accorded the central station and the substations by the last legislature insures their steady development and will tend to make the system increasingly effective.

UTAH.

Utah Agricultural Experiment Station, *Logan*.

F. S. HARRIS, Ph. D., *Director*.

All the work of this station is now on a project basis, which is proving very satisfactory. The work carried on in previous years has been continued and some new projects have been undertaken. The State appropriations have been increased from \$15,000 to \$17,500 for 1917, and will be further increased to \$20,000 in 1918.

An animal husbandry building is being constructed and the dairy barn has been remodeled. Twenty-six acres of pasture land have been added to the station grounds. Several changes were made in the personnel. E. G. Titus, the entomologist, resigned and was succeeded by W. W. Henderson, and H. R. Hagan was appointed associate. M. C. Merrill succeeded E. P. Taylor in the department of horticulture. A few changes occurred among the assistants.

Adams fund projects.—The study of the nitrates and their function in the soil was completed. A method was perfected for the determination of nitrate nitrogen in soils containing large quantities of soluble salts and organic matter. The factors effecting the formation of nitrates have been determined. Investigation of the factors influencing bacterial activity of the soil as measured by ammonification was mainly on the toxic action of various compounds. This action was found to be due largely to the electronegative ions, and, in general, the chlorids are the most toxic, followed by the nitrates, sulphates, and carbonates, respectively. The osmotic pressure exerted by a salt added to the soil plays a part in retarding bacterial activity, but is not the main factor, which is probably a physiological action of the substances on the living protoplasm of the cell, changing its

chemical and physical properties so that it can not functionate normally. The common soil alkalis, sodium chlorid, calcium chlorid, sodium sulphate, and the less common calcium nitrate are very toxic to ammonifying organisms, and, if present to any extent, greatly reduce the amount of ammonia produced in such a soil. Those compounds that are most active as stimulants to the higher plants are also most active in stimulating bacteria. The use of irrigation water increases the bacterial activities of the soil, rendering the nitrogen soluble, which is washed out by excessive amounts of water. Alfalfa not only feeds closer upon nitric nitrogen of the soil than do other crops, but it also increases the nitrifying powers, hence depletes the soil of its nitrogen more rapidly where the entire crop is removed than would other crops.

The entomological department has worked out the life history of the wheat straw worm and considerable data has been accumulated as to the amount of injury done to the wheat crop by the pest. Other insect pests that have been studied are the sugar beet leaf hopper and other insects affecting this plant, also alfalfa insects. Experiments in the use of poisonous baits for grasshopper control have been undertaken.

Poultry investigations have been continued along the line of improvement in egg production. An attempt is being made to secure data on winter and annual egg production as a basis for further selection. It has been found that the first winter's record is not necessarily an indication of the future performance of the hen.

The agronomy department has continued its studies on the action of soil alkali, special attention being given to the carbonates with the view of determining the nature of their toxic action. It has been found that they are much less toxic in soils containing large quantities of organic matter. Different crops were found to vary considerably in their resistance to alkali. Studies are also in progress on the toxic elements in irrigation waters, the determination of the concentration of the soil solution by the freezing method, and the movement and distribution of moisture in the soil. Work was begun on soil moisture constants in which specific gravity, texture, structure, temperature, and expansion as factors are to be investigated.

Work with Hatch and other funds.—In a series of irrigation and manuring experiments with corn it was found that stable manure applied to land every year for 6 years, when applied at the rate of 5 tons per acre, had an average value of \$3.57 per ton, but when applied at the rate of 15 tons, of only \$1.56. In irrigation experiments in Sevier County better results were obtained by irrigating the land before crops were planted. Potatoes require an even moisture content throughout growth and a number of small irrigations were much more effective than a few larger ones. Sugar beets, on the other

hand, are particularly sensitive to moisture conditions during the middle part of the growing season, while oats are most affected by the content of moisture in the soil during the early period of growth. Observations on pumping water for irrigating indicate that this is capable of much wider application than is now practiced.

Sugar-beet breeding has resulted in very high-yielding and high sugar-producing strains. The commercial production of sugar-beet seed has been successfully demonstrated and the amount of home-grown beet seed is increasing very rapidly. It is believed that under good conditions a ton of seed can be produced per acre. Some potato breeding work is under way. Two sprouts were found in a selected strain that outyielded all others and these have been grown separately with very promising results.

An artesian well survey of all the valleys in the State where such wells are available has been made and the pressure of the water, flow, and nature of the supply reservoir noted. Some new wells have been developed. In this connection a survey of the composition of a number of irrigation waters has been made. Nearly all were good for irrigational uses; some, however, were decidedly bad. The seasonal average of soluble salts of streams varied from 4.5 to 137 parts per hundred thousand. The soluble salt content of streams increases toward their mouths. For the most part the salts in solution in streams of low salt content are bicarbonates of the alkali earth metals. In the Sevier River more than three-fourths of the salts are sulphate and chlorids of sodium and magnesium, sodium chlorid predominating. In the Emery County district about half the salts are alkali earth carbonates, the remainder being mostly sodium sulphate.

About 35,000 buds were studied as to the temperature at which fruit buds are injured, and a survey of the State to determine the amount of frost injury is in progress.

Three years' results in the use of corn silage for feeding dairy cows to determine how far alfalfa hay may be replaced by silage show that about 3 tons of silage are equivalent to 1 ton of hay. Trials as to the amount of grain to be fed with corn silage were also made. The number of silos in the State increased several hundred per cent during the year. Fattening steers to determine the combination of feeds best suited under western conditions where alfalfa is plentiful and corn is high in price, is being tested. It was found that great care must be exercised in feeding beet molasses to young hogs.

A study has been made by the botanical department of the Rhizoctonia diseases of potatoes and the relation of different species of *Fusarium* to the characteristic effects produced on the tubers. It is found that sclerotia are not killed by the treatment that is ordinarily

recommended, but if the tubers are soaked before the treatment the poison is much more effective. It has been found that *Fusarium* wilt may be present in vines that do not show wilting in the field. Spraying at the right time was found to be quite effective in controlling peach blight due to *Coryneum* sp., which is destructive in the peach region of the State. *Phoma betæ* was found in many parts of the State, attacking both the leaves and roots of the sugar beet, and seems to be spreading rapidly. Among other investigations in progress by this department are studies of canning crop diseases, particularly of peas and tomatoes, the damping-off of seedlings in hotbeds, a *Fusarium* disease, and stem-end rot of tomatoes.

Considerable attention is being paid to fertility studies to determine the best methods of soil management for the maintenance of fertility. The influence of rotations, continuous cropping, and plowing under legumes with and without irrigation are being studied. Sources of potash in the native rocks and plants, as sagebrush, are receiving attention.

A number of dry-farm substations are maintained to determine the best cultural methods as well as the best crops and varieties, and the effect of different cropping systems on soil moisture.

The following publications were received from this station during the year: Bulletins 143, Fruit Tree Root Systems—Spread and Depth as Partly Determined by Excavations on the Southern Experiment Farm, St. George, Utah; 144, Water Table Variations—Causes and Effects; 145, Soil Alkali Studies—Quantities of Alkali Salts which Prohibit the Growth of Crops in Certain Utah Soils; 146, The Irrigation of Wheat; 147, The Alkali Content of Irrigation Water; 148, Breeding for Egg Production—I, A Study of Annual and Total Production; 150, Further Studies of the Nitric Nitrogen Content of the Country Rock; 151, The Freezing of Fruit Buds; 152, The Effect of Soil Moisture Content on Certain Factors in Wheat Production; 153, Selecting Dairy Bulls by Performance; 154, Irrigation and Manuring Studies—II, The Effect of Varying Quantities of Irrigation Water and Manure on the Growth and Yield of Corn; Circulars 21, Dry Farming in Utah; 22, Some Sources of Potassium; 23, The Seed Situation in Utah; and 25, Preserving Eggs for the Home.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15,000.00
United States appropriation, Adams Act-----	15,000.00
State appropriation-----	13,464.55
Sales -----	9,123.44
Miscellaneous, balance from previous year-----	128.02
Total -----	<u>52,716.01</u>

Despite the inevitable temporary effects of changes in its administration, the station has shown its fundamental strength, and its efforts have been well sustained. Its influence on the agriculture of the State is increasing steadily.

VERMONT.

Vermont Agricultural Experiment Station, *Burlington*.

J. L. HILLS, Sc. D., *Director*.

The station staff underwent some changes in the course of the year. A. F. Hawes, forester, resigned and this branch is now dropped as a station department. Other changes were among the assistants, and the positions vacated by resignation or otherwise were satisfactorily filled.

Aside from the fees from the fertilizer, feeding stuffs, and other control activities, which are used in the specific lines for which they are collected, the station receives a State appropriation of \$1,000 for printing.

Adams fund projects.—The study of forcing plants with carbon dioxid has been practically completed with the determination of the optimum application. The causes and limitations of the sterility of strawberries have been studied on 18,000 seedlings, some of the plants representing the third generation, to note the behavior of sexual characters in the offspring of crosses of perfect and imperfect varieties. Many varieties have been self-pollinated to determine the stability of certain types of sexuality. Nearly all the progeny from selfed plants were perfect and all imperfect strains were found to be hybrid in sexual construction. Many of the hybrids resulting from crosses of perfect and imperfect varieties were about equally divided as to their characters in the first generation. The native varieties were found to have imperfect forms.

Investigations on the carbohydrate content of maple wood, which have been in progress for some years, indicate that sugar in the tree is a protective agent and is the cause of the earliness of the sap flow in the maple. The birch freezes at temperatures that the maple will resist, and is about three weeks later in breaking dormancy in the spring. The leaf processes in the formation of sugar are now being studied.

The nutritive value of milk of different grades has been studied by feeding experiments with pigs, the phase of the question studied this year being artificial milk mixtures made from skim-milk powder, milk sugar, dextrin, maltose, and unsalted butter. The fat percentage was kept down to three or less, with a varying amount of protein. Five litters of eight pigs each were fed, slaughtered, and analyzed. Relatively poor utilization of milk sugar and fat, but a very

good utilization of the protein, was secured. Holding the food calories down to 50 per pound of live weight did not produce desirable growth, the pigs being lean although vigorous, active, and healthy. When the calories were raised to 75 the gains were satisfactory.

Feeding trials of various amounts of protein with dairy cows have given some striking results and will be continued. The maintenance ration of dairy cows is being investigated in regard to lactation and fetal development. The importance of exercise as a factor in maintenance requirements was strikingly shown. It is observed that some of the cows after being dry for two or three years show a tendency to become coarse or "steery" in the neck. A study of the food cost of metabolism in dry cows showed that individuality plays such an important part that a wide range of observation must be made before definite conclusions can be arrived at. The nutritive value of milk of varying composition for infant feeding was vigorously pursued, using young pigs as laboratory animals. Two of these were killed and analyzed as checks, the remainder being fed on different amounts of protein and other rations until they had doubled in weight, when they will be killed and analyzed to determine the effect of the ration on muscle building and the accumulation of fat.

The veterinary department has been working on the control of blood complement, which was somewhat interrupted by an outbreak of hemorrhagic septicemia resulting in the death of 1,400 guinea pigs used in the investigation. A change in food by the addition of skim milk corrected this. Since the beginning of the work 3,549 pigs have been tested, of which 1,350 were without complement. Where both the parents were without complement the offspring were invariably so. From matings of normal animals all the offspring were with complement.

Tip burn of the potato is found to be controlled by Bordeaux mixture. Several other plants have shown symptoms similar to those of the potato. Chlorophyll destruction seems to bear a causal relationship to the malady. In the older leaves the chlorophyll disappears and is replaced largely by xanthophyll and carotin. Studies on the osmotic pressure in the root, stem, and leaves indicate that this plays a rôle in the appearance of tip burn. Potatoes grown under shelter are free from the disease. The resistance of varieties to this disease has been studied, also the resistance to potato scab and the relation of the structure of the skin and the effect of fertilizers and soil disinfection to the scab. Certain thick-skinned, russeted varieties appear quite resistant; in one instance only 5 per cent of the crop was scabby, while with thin-skinned varieties the entire crop was affected. No constant relation was noted between the bacterial content of the soil and the disease.

The tolerance of forest trees was found to be due to the combined action of many factors, of which light was apparently not the most important. The physical factors were studied separately, including those which go to make up the weather, and their influence on forest seedlings noted. The influence of moisture, shade, and fertilizers was conducted in the greenhouse. It was found that the leaves may be shortened by limiting the supply of water. Western species will grow in Vermont in the absence of shade. Distance experiments are in progress by growing young white, red, and Scotch pines at distances of 2, 4, 6, and 8 feet apart.

Studies on the origin of species and the development and improvement by hybridization of the blackberry and the segregation of Mendelian characters are being made on seedlings from artificial crosses and from natural hybrids. It is found that wild species or strains when grown under different conditions show marked differences in character of growth.

Work with Hatch and other funds.—The study of the quality and quantity in Hubbard squash was continued, attention being given to the correlation of edible quality and chemical composition and to the quality of the same strain at different storage periods; also to determine to what extent the yield may be influenced by seed selection, and different methods of pollination and by the use of large and small seed. The range of variation worked out by the data obtained and the coefficient of variability were determined. It was observed that the plants with the greater number of leaves produced the most fruit by weight. Scion selection has been studied, comparing scions of supposedly low and high productive powers with data as to blooming, set and yield of fruit, and growth. This has not as yet given definite results. The storage of fruit and vegetables without the use of heat and ice has been tried in suitable storehouses. The temperature can be controlled within certain limits only and under these conditions observations on the lasting qualities of the varieties are tried.

The complement fixation test for contagious abortion was widely used. Owing to the prohibitive cost of methylene blue another cresol compound was substituted with good results. Forty-five cows that gave the reaction were selected for trial, 15 receiving no treatment as checks and 30 being treated with the cresol compound. Among the 30 treated cows there were 3 abortions, while among the 15 untreated ones 10 abortions occurred. The cresol was given in molasses in the proportion of one part to three or four and fed on silage or grain. Two ounces of the compound have been given without untoward effects. The cresol costs about 32 cents per pound and a cow can be treated for 3 weeks for about 60 cents. Cresol alone in the laboratory was found to have good bactericidal action.

Mechanical tests carried out in the engineering laboratory on the wood of eccentric trees show that the two sides differ greatly in tensile and compression strengths. Accurate records of changes in the vegetation of forest plats have been kept, including both qualitative and quantitative analyses of the vegetation to find, if possible, the causal factors of plant succession.

The publications received from this station during the year were as follows: Bulletins 193, Studies in Tolerance of New England Forest Trees—III, Discontinuous Light in Forests; 194, The Trees of Vermont; The Structure and Identification of Our Common Lumber Woods; 195, Studies of the Values of Different Grades of Milk in Infant Feeding; 196, Some Studies on Bordeaux Mixture; 197, Commercial Feeding Stuffs; Concerning the Oat Crop; 198, Commercial Fertilizers; Concerning Tillage; 199, Twenty-ninth Annual Report, 1916; 200, Concerning Weeds and Weed Seeds; 201, Value of Different Grades of Milk in Infant Feeding; Circulars, 9, Publications for Free Distribution; 10, Concerning the Use of Commercial Fertilizers in 1916; 11, Concerning Certain Technical Bulletins and Concerning the Annual Report; and the Annual Reports for 1915 and 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation.....	1,000.00
Individuals	5,395.08
Fees	2,996.75
Total.....	39,391.83

The Vermont station is making an effective showing for the funds at its disposal, and has important lines of study in progress. Noteworthy success was had during the year in the dissemination of results obtained.

VIRGINIA.

Virginia Agricultural Experiment Station, Blacksburg.

A. W. DRINKARD, Jr., Ph. D., *Director*.

The year was a prosperous one for the station, and all lines of activity progressed in a satisfactory manner, with a fine spirit of cooperation in the staff. There is evidence of increasing appreciation of the work on the part of its constituency. A few changes occurred in the staff during the year, but no net increase of force. G. C. Starcher, assistant horticulturist, resigned to go to the Alabama station. G. S. Ralston was appointed field horticulturist, and S. A. Wingard was appointed in the plant pathology department.

The station continues to operate nine county stations. For these there is available a State appropriation of \$16,000 and an allotment from the State board of agriculture of \$6,750 from the fertilizer tax, together with the sales of the respective stations. Three of these stations are supported entirely by the State department of agriculture.

Adams fund projects.—Owing to unfavorable weather conditions investigations on the effects of soil environment on fruit-bud formation were somewhat hindered. Cultural treatment apparently had more effect on the orchard than differences in fertilization. The same unfavorable conditions applied to the work on apple breeding, although one promising seedling has been found.

Both pot and field experiments are used in studies of the availability of phosphoric acid and its fixation and on the availability of other plant foods in the soil. In the field 200 pounds of acid phosphate to the acre were found to give as good results as 600 pounds. With the application of 1,200 pounds of lime with no phosphoric acid the yield fell off rapidly. The application of 1,800 pounds of lime to the acre had no appreciable effect until the sixth year, when the soil became alkaline and the yield immediately increased and was then maintained at about 37 bushels per acre by using either 200 pounds phosphate rock; acid phosphate; basic slag; or phosphate rock, manure, and lime. The use of fifth-normal nitric acid as a solvent for available phosphoric acid from different sources did not agree with the results obtained in the field. Excess of phosphoric acid that is added to the soil is fixed by the iron, lime, or alumina, but is still available although no longer soluble in fifth-normal nitric acid. The effect of the action of manure and lime on the solubility of potash was studied, but the amount of soluble potash remained about the same with any treatment.

Investigations on the effect of green manuring on the soil, which have been in progress for four years, have yielded some interesting results. It is found that soil acidity due to green manuring is very transitory. On corn plats with clover turned under the increase in yield was 26 bushels to the acre; where the clover was cut off and removed it was 18.4 bushels. To determine the proper state of development of crops to get the best results in plowing under, cuttings were made at different intervals and analyzed. The first cutting of rye was made April 14 and this was repeated at two-week intervals. That cut April 14 contained 21.59 per cent protein, while the mature plant cut June 19 contained only 5.4 per cent, but with a large increase in crude fiber.

Investigations as to the principles governing the growth and maturing of corn show that an abundant supply of moisture in the early part of the growing season was more important than at the time of

tasseling, at which stage a too abundant supply appears to delay maturity. The effect of hybridization for the first year was an increased yield and earlier maturity than the parents. A study of the correlation between size of kernel and germination showed that the smaller the kernel the earlier the germination. In certain varieties the earlier germinating kernels produce ears that mature two or three days earlier than the average. From early and late germinating kernels from the same ear the former mature later, which is explained by the fact that the small kernels form last and are pollinated by later varieties. The black root rot of the apple was found to be caused by a species of *Xylaria* not previously considered pathogenic. A survey of the State showed it to be prevalent throughout the apple-growing regions and that in many places it is the most destructive single pest with which the apple grower has to contend. Attempts to connect it with soil types have not been successful but it appears to be more prevalent in newly cleared land and on old stump land. It is not found safe to replant after removing infected trees, indicating infection of the soil, and it appears to be spread by cultivation. The peach, pear, and cherry may be susceptible but this is not definitely proven yet. The problem of control seems to rest on the possibility of finding some resistant root stock. There appears to be no specific treatment for it and soil disinfection does not offer much promise.

Work on the relation between parasitic fungi and their host plants has been carried on with rust on the bean. Wide variations in susceptibility are found. The horticultural pole bean is practically resistant and the properties of the cell sap of this plant have been studied with no satisfactory results as yet, resistant and susceptible varieties showing no appreciable difference.

Investigations on nitrogen fixation and nitrification on different soil types show among other things that nitrification always requires air but that ammonification and nitrogen fixation may be aerobic or anaerobic, showing no particular difference under the two conditions. Denitrification appears to go on a little better under anaerobic conditions. With a nitrifiable substance (ammonium sulphate) added to increasing amounts of sodium nitrate, the nitrification decreased as the nitrate increased.

Experiments on the utilization of rations and the protein and energy requirements for milk production have been carried on two years. Two lots of cows have been fed continuously for this period, one a narrow nutritive ration of 1:2.4 and one a wide one of 1:11. The high protein cows have maintained a rounded, well-fleshed appearance. The high energy animals, on the other hand, became extremely emaciated under the strain of milk production and could not maintain their weights until their milk flow almost ceased. The

results of digestion experiments on these two groups are interesting. The cow that received the high protein ration was consuming only 75 per cent of her ration, but this amount supplied her with sufficient energy and more than twice as much digestible protein as was necessary. The digestibility of the protein was 28 per cent above the average; therefore a large amount of protein in excess of the requirements for maintenance and milk production were digested. With the high energy cow it was found that the coefficients of digestibility of all nutrients were reduced to a remarkable extent. The reduction of the digestibility of the protein, which under normal conditions was present only in sufficient quantity, caused protein starvation and consequent rapid loss of flesh when milk was being produced.

Work with Hatch and other funds.—Extensive variety and selection tests have been carried on and several promising strains of wheat and oats have been obtained. The cultivation and noncultivation of corn has been compared for the past four years. The noncultivated plat yielded 8 bushels to the acre; when the weeds were shaved off but no cultivation given, 49 bushels to the acre; and when three cultivations were given, 59 bushels to the acre.

Grazing experiments in cooperation with the United States Department of Agriculture show that close grazing is better than light grazing, that it was profitable to fertilize pastures with acid phosphate, and that top-dressing with lime was beneficial. Cooperative experiments were also carried on for the eradication of hawkweed. Three thousand pounds of salt to the acre kills both weeds and grass, but the latter returns.

Experiments in root pruning, ringing, girdling, and stripping show that these may sometimes stimulate the tree, but the wounds must be protected or permanent injury results. Paraffin paper tied over the wound insures healing.

Various studies have been made in the department of entomology in relation to the transmission of disease by Aphididæ, with a general study of the immunity and susceptibility of trees to these insects. The control of scab in commercial apple orchards was found to be quite satisfactory by the use of sulphur and arsenate of lead with lime as a filler, although it caused some leaf and fruit injury. Leaf spot disease of tobacco was found to be quite prevalent, especially on bright tobacco, which appears to attack mature or nearly mature plants only. Early harvesting was therefore practiced in many cases. It does not appear to affect tobacco grown on unfertilized land or land where no phosphoric acid has been applied. A bacteriological study of fresh and decomposing horse manure showed a great abundance of *Bacillus coli* and allied forms in the fresh manure, but these rapidly decreased, only 8 per cent remaining after one month, their

place being taken by spore-forming types, many proteolytic forms appearing.

In a comparison of steers on pasturage alone with those receiving from 1 to 4 pounds of cottonseed meal a day in addition, those receiving the cottonseed meal did not graze as long each day and did not give as good gains as those which depended entirely on grazing. Experiments in feeding dairy cattle silage with cottonseed meal, linseed meal, bran, and peanut meal, respectively, to give the same amount of energy showed that cottonseed meal and linseed meal gave the best and cheapest gains, peanut meal being next best and bran the least advantageous. A self-feeding experiment with dairy cows in which corn, bran, cottonseed, linseed, and peanut meals were each fed separately—the cows to select the amounts of each, according to their preference, the cows ate about twice as much of the grain as those that had the grain weighed out to them and gave no better returns.

The publications received from this station during the year were as follows: Bulletins 211, Effects of Binders Upon the Melting and Hardness of Ice Cream; 212, Sudan Grass; 213, Spraying and Dusting Tomatoes; 214, Corn Culture; Technical Bulletins 10, Some Effects of Temperature upon the Growth and Activity of Bacteria in Milk; and 11, North American Varieties of the Strawberry, with a Bibliography of North American Literature of the Strawberry.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15,000.00
United States appropriation, Adams Act-----	15,000.00
State appropriation-----	21,062.51
Farm products-----	7,233.01
Miscellaneous-----	399.60
Balance from previous year-----	6,990.48
Total-----	65,685.60

The work of the Virginia station is related to the leading problems of the State, and the provision of branch stations under State appropriations and with the aid of the State department of agriculture enables the experiments to be extended to various sections and to the principal branches of agricultural industry. It is rendering useful service and is efficiently administered.

WASHINGTON.

Washington Agricultural Experiment Station, *Pullman*.

GEORGE SEVERANCE, B. S., *Acting Director*.

The director of the station, I. D. Cardiff, resigned in April, 1917, and George Severance was appointed acting director. An advisory

staff composed of the heads of the more important departments was provided. Some minor changes were made in the corps of assistants.

A portion of a recent purchase of 157 acres of land by the college will be available for the station and will be used for feeding experiments. The resources of the station included about \$34,000 from State appropriations. About \$2,500 was appropriated for co-operative experiments with the Bureau of Plant Industry, United States Department of Agriculture. The western Washington station at Puyallup, maintained entirely by State aid and not under the supervision of the director of the Federal station, received an appropriation of \$28,363.

Adams fund projects.—Inheritance studies of wheat have been largely along the line of smut resistance and some F_2 hybrids have been produced that exhibit a high degree of resistance. Other points studied include inheritance of beard, length of head, and grain color.

Some interesting results have been obtained from a study of the metabolism of the tubercle bacilli. Bovine and avian types have been successfully grown on synthetic media and recently some success is being attained with bacilli isolated from human sources. Most of the organisms investigated contained wax within the cell wall and the failure to secure bacterins is believed to be due to this. Some work is in progress on the agglutination test as an early means of diagnosis.

Work on the tomato blight has been extended to include a general study of Rhizoctonia diseases of the potato, beans, and other crops. Negative results only were obtained in attempts to produce tomato blight by inoculation with *Fusarium*. About a dozen species of weeds, and all crop plants except cereals, have been found to act as host plants for various species of Rhizoctonia. It has been found that the organism is capable of living for several years in the soil, but how long it may remain viable has not been determined.

A chemical study of the process of ripening of the prune is under way. Trees were selected in representative orchards in different parts of the State and samples of fruit taken from July to October or November, when the fruit was fully matured. Analyses are being made of these samples. So far, the results show that the prune is very low in carbohydrates throughout its entire period of growth until within two or three weeks of the time of the fall of the fruit. The prune as a source of pectin is being studied, also the cause of the astringency and the nature of its change as the fruit ripens.

The function of sulphur as a plant food was studied on plants grown in quartz sand and in virgin soil in the greenhouse, various forms of sulphur being added. The crops grown were wheat, oats, barley, peas, vetch, soy beans, and alfalfa. The plants grown in

quartz sand responded to the application of sulphur in various forms, but the results from those growing in virgin soil were not so marked.

The progressive development of the wheat plant has been followed, especially in the formation of gluten and in an attempt to isolate an enzym which would have the property of synthesizing the amino acids into more complex substances such as proteins. Other phases of the work are to be taken up.

A determination of the nitrate content of different soils at different times and the nitrate content of the wheat grown on these soils has been made to determine the existence of any possible relation between these. Winterkilling and insect depredations have interfered with the project, but from the data secured it seems evident that there is an increase in the nitrogen content of wheat grown under favorable conditions of soil preparation and in rotations in which leguminous plants are included. In this connection the influence of cultivation on the nitrogen content and yield of wheat was investigated, the results clearly showing that the nitrogen content of wheat may be increased both by cultivation and by keeping up the humus and nitrogen content of the soil.

Studies on the baking qualities of flour have included fermentation and baking tests with the addition of various portions of the alcohol-soluble extract from flour and also the effect of various chemicals on fermentation processes, texture, and size of loaf. Results indicate that the fermentation period can be shortened or lengthened, depending on the amount of sugar, salt, yeast, and water. As an emergency study various substitutions for wheat flour have been tried, especially in the use of pea and soy bean flour mixed with the wheat to reduce the amount of the latter consumed as well as the cost without reducing the food value of the product. The results thus far are encouraging for the use of these substitutes, the bread being light and pleasing to the taste and the composition being theoretically better than that of pure wheat bread.

A physiological study of the changes produced by endoparasites on the host has been mainly on the cabbage aphids and many microphotographs illustrating these changes have been secured. The progressive immunity of insects to insecticides was studied by applying identical spray mixtures comprising various concentrations of lime-sulphur, soda-sulphur, and several oil sprays to dormant San José scales in many different localities, the rate of mortality in each case being noted. The results showed a marked difference in resistance manifested by the insects in the various districts. An attempt is now being made to detect differences in the various strains by their hæmolytic action on mammalian blood, extracts from the various scales being tried on rabbits' blood. A measure of the biological

difference in the scales of the several regions is now being sought by immunizing guinea pigs to the scale toxins and then trying complement fixation reactions.

The cause of the winter desiccation of fruit trees does not appear to be due to winter conditions so much as to nutritional disturbances. Rather extensive soil studies, including analyses for alkali, nitrates, moisture, and other factors, have been made, also cultivation versus cover crops as contributory factors. Pot cultures are under way to determine the influence of varying amounts of nitrates, sodium salts, and other elements on the extent of the injury. Studies on the moisture and nitrate content of soils have been made to determine the relation of these to plant growth and the influence of different methods of tillage and cropping on these factors.

The veterinary department has been engaged in an investigation of goiter and associated conditions in domestic animals. Various experiments are under way to determine if this may be due to the water supply, deficiencies of local grown foods, or improper nutrition, and the possibility of correcting the abnormal condition of various iodine treatments. Evidence points toward unbalanced feeding as a prominent cause.

From estimates based on the cost of exterminating the Columbian ground squirrel from a 160-acre tract recently acquired by the college, it is found that this can be done with carbon disulphid at a cost of about 75 cents per acre. A slight explosion of the gas is preferable, but not necessary.

Work with Hatch and other funds.—The work of the agronomy department has included a large amount of variety tests of cereals, principally wheat, oats, corn, barley, rye, sorghum, flax, and peas. In the wheat variety tests Triplet, a hybrid originating in the station nursery, led with an average yield of 45.25 bushels per acre. Of the spring wheats a hybrid between Kubanka and Bluestem gave the highest yield, averaging 41.42 bushels per acre. Bluestem, for many years the standard spring wheat of Washington, averaged 36.37 bushels. The best yield in oats was obtained with Abundance. Of the barleys, Tapp yielded 89.9 bushels per acre. Of the field peas tested, Blue Bell ranked highest. The effect of smut on the yield is being noted. Forage-crop investigations in cooperation with the Bureau of Plant Industry, United States Department of Agriculture, include the seeding of alfalfa, clover, and orchard grass with and without nurse crops and the value of various forage crops for silage. The department has grown and distributed a large amount of improved seed of the most promising varieties of wheat, peas, and corn.

The sources of field infection of smut and its control are receiving considerable attention. A large percentage of smut damage arises

from the fact that at thrashing time smut is scattered over the entire surface of the tilled land in the wheat belt. Spore traps have shown that immense quantities of spores are carried to great heights and distances, in one instance being collected on top of a butte 1,000 feet above the wheat field. There is usually not enough rain to germinate the smut and cause it to die out before seeding time, consequently wheat that may be properly treated is contaminated again when seeded into this smut-infested surface. Deep plowing of summer fallow before planting has been found to materially reduce the percentage of smut, and spreading and burning straw on fallow fields gave beneficial results. Any manipulation that avoids mixing the treated seed with the smut-infected soil surface shows a reduction in the percentage of smut. Methods of catching and destroying a large percentage of the smut at the thrashing machine are being tried.

Valuable practical results have been obtained from a study of the construction of fruit-drying plants. Many sets of plans have been distributed in this and adjoining States for this industry, which are now in successful operation. As a result of the establishment of these plants it is claimed that approximately 225 tons of fruit a day throughout a working season of 50 to 100 days are being conserved where formerly it was allowed to rot in the orchard. A biochemical study of apple varieties and their relation to cultural treatment, character of soil, irrigation, and rainfall is in progress. In addition to this, the botany department has grown and distributed legume cultures and conducted investigations on the silver scurf of potatoes, currant anthracnose, gooseberry mildew, and sorghum smut.

A number of dry-farming projects are being carried on at the Waterville and Lind substations, including variety tests of cereals and forage crops, tillage investigations, fertilizer and rotation tests, and tree trials.

Methods for the control of the strawberry root weevil, which is a serious menace to the industry, are being successfully worked out. Disastrous outbreaks of the blackhead fireworm, threatening the cranberry industry of the State, called for emergency work by the entomological department. Orchard pollination studies indicate that pollination by insects is effective only so far as it involves cross-pollination. The development of pollen tubes and processes of fertilization have been studied in self-pollinated and cross-pollinated blossoms. Tests of the vitality of pollen showed that in some cases it retained its vitality for 26 days.

While there is considerable difference in the keeping qualities of irrigated and nonirrigated apples, the moisture content of the soil is of secondary importance if it is within the limits of favorable growth and development of fruit. A study is being made of the

factors that may influence the keeping quality, as size and temperature during the final stages of growth, this latter factor appearing to play an important part. Orchard cover crop trials with field peas, rye, wheat, and oats show that the best results come from that crop that furnishes the most vegetable matter, irrespective of the crop itself. Extensive variety tests of garden vegetables showed that only a few were adapted to the soil and climate of the State.

The following publications were received from this station during the year: Bulletins 132, Isolation and Cultivation of Bacterium Tuberculosis on a Synthetic Culture Medium; 133, A Soil Survey of the Proposed Palouse Irrigation Project; 134, Sheep Husbandry in the Pacific Northwest; 135 Inheritance in Wheat, Barley, and Oat Hybrids; 136, Annual Report, 1916; 137, The Coulee Cricket (*Peranabrus scabricollis*); 138, First Annual Report of the Adams Branch Experiment Station, 1916; 139, Microchemical Studies in the Progressive Development of the Wheat Plant; 140, Field Pea Production; 141, Barley in Washington; 142 Gluten Formation in the Wheat Kernel; 145, The Estimation of Sulphur in Plant Material and Soil; Popular Bulletins 99, Ground Squirrel Control; 100, The Control of Fruit Pests and Diseases; 101, Controlling the Coulee Cricket; 103, Canning Without Sugar; 104, Cost of Pumping for Irrigation; 105, The Possibilities of Sugar-beet Culture in Washington; 106, Potato Growing in Washington—I, Potato Growing; II, Potato Diseases; III, Potato Insects; 107, Winter Sprays—Lime-sulphur Spray and Crude Oil Emulsions; 108, Tree Planting in eastern Washington; 109, Celery Culture; 110, Cabbage and Cauliflower Culture; 111, Bean Culture; and Index to Popular Bulletins Numbers 1 to 100.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation.....	33,964.70
Individuals, including balance from previous year.....	2,922.22
Sales, including balance from previous year.....	24,202.39
Total	91,089.31

The station has important lines of investigation in progress that are intimately connected with the industries of the State. These promise results of great practical value.

WEST VIRGINIA.

West Virginia Agricultural Experiment Station, Morgantown.

J. L. COULTER, Ph. D., Director.

Emergency work occupied the time of the director to a large extent during the year, and several changes in the staff took place. This

had its effect on station activities, but the main lines of investigation were carried on and much work was accomplished. F. E. Bear, head of the soils department, left early in the year, and I. S. Cook resigned as agronomist, but was retained as consultant in that department. F. W. Stemple was appointed to the position of agronomist.

The station received a direct appropriation from the State of \$20,000, in addition to the receipts from fertilizer inspection and farm sales. Provision has been made for an annual appropriation of \$35,000 for the next two years. About \$4,000 was appropriated for a new poultry plant and \$16,000 for the erection of new farm buildings and for repairs. New greenhouses were completed and put into service. Provision has been made for the construction of a new animal husbandry barn. The new agricultural building which is being erected at a cost of \$187,000 is nearing completion. The station has had deeded to it a well-equipped and stocked dairy farm of 1,000 acres and 150 head of high-class dairy cows, located in the eastern part of the State. The fertilizer control has been transferred from the station to the department of agriculture, although the analytical work will be done at the station.

Adams fund projects.—Poultry investigations have been actively carried on. The characteristics of eggs have been studied in connection with the project on the influence of management and breeding on the vigor of the germ. The main conclusions from this study are that the larger the egg the larger is the yolk, but the smaller percentage of the egg is yolk. With eggs laid in cycles the first is usually the heaviest, the other eggs decreasing in weight through the series, and the same relation is true of the weight of the yolk. The eggs laid by individual hens vary widely in the average weight of egg and yolk and in the percentage of yolk to total egg. The presence of a considerable amount of animal protein in the ration tends to weaken the vitellin membrane. It is proposed to measure the vigor of the embryo by the amount of carbon dioxid given off during development, and a new incubator has been constructed in which the temperature and moisture can be accurately controlled, which will permit of these determinations. An arrangement for supplying carbon-dioxid-free air is also provided for.

A study of the correlation between the lime requirements of the soil and its bacterial activity was interrupted by the resignation of the agronomist, but some phases of the work will be carried on by his successor. An extensive study has been made of pollen tube development in connection with the pollination of the apple, and a planting of dwarf trees has been made from which material will be obtained. The study has included careful observations on the development of the pollen tubes, their structure, rapidity of growth, and tube contents. Blocks of callous tissue appear in the tube at inter-

vals, entirely closing off the tip and its contents from the older and now useless portions of the tube. It was found that nearly all of the varieties of apples in the region investigated were self-sterile or nearly so.

Cucumber mildew was found to be causing serious injury in the State. Attempts to secure the fungus causing it in pure culture have not been successful, but histological studies are being made of it and methods of control will be taken up.

Some progress has been made in the study of the relation of temperature to insect life. The metabolic activity was measured by means of the carbon dioxid output, which follows very closely the curve established for the rate of development. The metabolic activities of caterpillars which hibernate will be studied before, during, and after hibernation to discover the relation between these activities and pupation.

Investigations on the apple rust have been carried forward quite successfully. The reason that some cedar trees are affected by this rust and others not is being studied, also the extent of cedar-free area that should be maintained around commercial orchards. A clearing of two miles' radius was made. While the season was not especially favorable for rust the value of clearing away all cedars near orchards was evident. The effect of rust on leaf fall, the relation of weather to infection, and the dissemination of the spores, the relation of age of leaf to susceptibility, and the immunity of varieties are under observation, the latter point being studied by chemical analysis of diseased and healthy leaves.

Some valuable results have been obtained from the study of the effect of pressure on enzymes and bacteria, and an apparatus has been devised for this purpose that it is believed will offer many advantages in sterilizing media that might be injured by heating. This apparatus is not cumbersome and is easy to operate and regulate. It may be run over night without attention, thus saving much time in sterilizing. It was found that a pressure of 100,000 pounds per square inch was sufficient in most cases, although certain spores survive this. When spores are moist they are readily destroyed by high pressure. In milk held under a pressure of 70,000 pounds for a few minutes no pathogenic organisms developed under laboratory conditions. Inoculation experiments with animals are to be conducted to confirm the results obtained in cultures. A constant temperature should be maintained, and it was found that 37° C. was satisfactory. Some work has been done with enzymes under pressure, with no definite results as yet.

The physiological effect of pruning apple trees is being observed, with comparative studies of fruit and root development. Severe

summer pruning has been found to be detrimental to fruiting, the lighter the pruning the greater being the yield. Experiments are also in progress on the effect of light summer pruning and pinching out buds on fruit-bud formation and behavior under various types of pruning.

Preliminary work has been done on the control of insects by means of impregnation of the sap with poisonous substances, mainly on the technique of the problem, by testing the relative ease of injection through holes in the trunk, through branches, and through roots of various dyes, as eosin and methyl blue, and the rate of absorption and direction of transportation. When these points are established the injection of poisons will be tried.

Some preliminary investigations on the nature and intensity of soil acidity have been carried out from which it appears that the active acidity of soils and their lime requirement are not necessarily correlated. Some work has been done to determine what mineral elements in the soil are responsible for its acidity.

Work with Hatch and other funds.—The chemical department, as emergency work, has undertaken some investigations on the possibility of the utilization of coal gas as a source of nitrogen, and also experiments on the storage of eggs. Eggs sterilized in hydrogen peroxid and wrapped in cotton have kept in perfect condition for a considerable time when stored in a cool place.

The horticultural department has numerous lines of investigation under way. The tests of Irish-potato breeding have narrowed down to three varieties, Irish Cobbler, Rural New Yorker, and Carman No. 3. There are under observation 191 of the most promising seedlings. Thinning overlaiden apple trees always resulted in the improvement of the crop in size, color, and quality. The influence of thinning on the formation of buds for future crops was entirely negative. From variety tests with sweet potatoes the Big Stem Jersey is the only one recommended for planting.

Fertilizing experiments with apple and peach trees show the favorable action of sodium nitrate on the latter, increasing both the size of the tree and the crop. In a few cases it apparently caused a large crop of small-sized fruit that may, however, have been due to the lack of proper thinning. In one case, on somewhat richer land the tree was so stimulated that ripening of the fruit was considerably delayed and excessive shading caused lack of color. With apples the effect of fertilizers was not so apparent. In young bearing orchards the effect of the application of fertilizers appeared to be entirely negative. In old bearing orchards that have been fertilized for some time the effect is just beginning to be noticed.

Potato-culture experiments have included a comparison of yield from the seed and stem end of the same tuber, of different spacing in planting, of the use of whole and cut seed, and of planting sprouts removed from the tubers. Variety tests of fruit trees and bush fruits with fertility and pruning tests of the latter are being carried on. Variety, cultural, and fertilizer tests are being made of strawberries. There was apparently no response from acid phosphate and potash, but an increase of vigor of vine and crop of fruit with nitrogen. Heavy applications of lime had no material influence. Breeding has so far failed to fix the type selected and will be continued to determine if the strawberry is such a stable fruit, with a high fluctuating ability, that it will produce few if any mutants that are capable of being isolated by selection. Other activities of the department have included a test of spray nozzles, a small-fruit survey, maintaining demonstration orchards, and preliminary work on the physiological effect of pruning fruit trees.

For the control of apple and peach tree borers various concentrations of oil sprays have given the best results, from 80 to 90 per cent efficiency being secured on a commercial scale. The control of the round-headed tree borer can be effected by screening the trunks with bronze wire gauze, but this would only be practicable for small orchards or for trees for home consumption. Painting the base of the tree with asphaltum seems to keep the beetles from laying their eggs in the bark. The codling moth and plum curculio on the apple and the latter on the peach can be controlled by the dusting method as well as by wet sprays. Encouraging results were also obtained in the control of scab and brown rot of the peach by dusting.

Soy bean and cowpea varieties have been tested both for seed and hay production. In variety tests with oats and barley, Culberson and Turf were the best winter oats and Tennessee the best winter barley. Of the spring barleys the Svanhals and Hannchen were best, the poorest being the Red Beardless. The best varieties of spring oats were Big Four, Kherson, and Selection 155 from Iowa. The results of these tests show that winter barley is a much more profitable crop than winter or spring oats, and that spring barley will give nearly as many bushels as the best spring oats. There appears to be a future for winter barley in the State. Extensive studies are in progress on the grasses of the State available for hay and pasture. Cooperative tobacco variety and curing tests are being conducted with the United States Department of Agriculture. Early plowing produced decidedly the best yields of buckwheat.

The influence of green feed on egg production for poultry during the winter has received attention. It is believed to have an effect on fertility and hatchability. The station has distributed a great

many pure-bred cockerels and hens to boys' and girls' club workers and others and the demand for these is constantly increasing.

Tomato diseases were controlled satisfactorily either with Bordeaux or sulphur dust or with Bordeaux spray. Good results have been obtained for the control of peach scab with sulphur dust. Bordeaux mixture gave better results for the control of apple diseases.

A cooperative experiment on growing beef cattle is being carried on with the United States Department of Agriculture by the animal husbandry department. A test of various varieties of roughage for feeding steers was made, including rye, soy beans, and mixed hays. Feeding experiments with sheep to determine the cost of winter feeding and trials with silage and various forage crops with pigs have been carried on with good results.

Labor income records were made on 275 farms and data on cost of production for growing crops in West Virginia have been secured and published.

A project on the potential fertility of West Virginia soils included the analyses of 115 samples from 24 counties, as well as studies on methods of analysis of soils with the object of rendering them better adapted to routine work, resulting in some new procedures.

The following publications were received from this station during the year: Bulletins 152, White Burley Tobacco; 156, A Second Report on the University Farm Garden; 157, Silos and Silage; 158, The Apple as Affected by Varying Degrees of Dormant and Seasonal Pruning; 159, Methods in Soil Analysis; 160, The Residual Effects of Fertilizers; 161, Analyses of One Hundred West Virginia Soils; 162, Five Years' Investigations in Apple Thinning; 163, Amount and Cost of Labor Required for Growing Crops in West Virginia; 164, Pruning Fruit Trees; Inspection Bulletin 5, Commercial Fertilizers, Inspection 1916; Circulars 23, List of Available Publications; 24, The Production of Eggs for Hatching; 25, The Incubation of Hen Eggs; and 26, Brooding and Feeding Little Chicks.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation.....	20,000.00
Fees.....	16,321.47
Sales, including balance from previous year.....	8,615.76
Total.....	<u>74,937.23</u>

The increased income and facilities recently given to the station indicate that the importance and value of its researches are becoming better recognized and appreciated, and that its influence is gaining in the State.

WISCONSIN.

Agricultural Experiment Station of the University of Wisconsin, *Madison*.

H. L. RUSSELL, Ph. D., *Director*.

The work of this station has been continued in a very satisfactory condition. The State gave liberal support, appropriations aggregating over \$97,000 for the fiscal year. An appropriation of \$18,500 was made for the three branch stations, and a new substation was established at Hancock. A special appropriation of \$37,500 was made to demonstrate the clearing of cut-over land by the use of stump pullers and dynamite. A new soil laboratory, costing \$58,000, is nearly completed. An annual appropriation of \$1,500 was made for experiments on muck soils.

The station is to be relieved of all control work, which will be taken over by the State commissioner of agriculture. An active part was taken by the staff in the food production campaign and war emergency work.

Adams fund work.—The projects on the importance of the mineral constituents of feeding stuffs on the growth and development of farm animals and on the comparison of nutrients from single plant sources and from different plants on the development of animals have been actively pursued during the year. Feeding experiments with wheat and corn were continued with cattle, pigs, and poultry. Wheat has been found to be lacking in certain ash constituents and in proteids, and to contain mildly toxic principles that proved injurious if fed excessively. Corn was found to be a better balanced ration. Experiments with oats along the same line are being made. Clover and alfalfa have been found to be excellent for balancing these grain feeds. Various seeds as rations were studied and none of them proved to be perfectly balanced, being deficient in sodium and calcium salts. The addition of calcium carbonate to such feeds gave good results. Millet seed came the nearest to being a balanced ration. The leaves of the different plants were found to be very different, from a nutritional standpoint, from the seeds of the same plant, leaf and seed mixtures in many instances making good rations. The exclusive feeding of seeds to poultry was not found to be so detrimental as to other animals. Grain alone can not be fed to pigs. In feeding experiments with rats, 50 parts of corn, 30 parts of alfalfa, and 20 parts of peas gave the best results of any combination of wholly vegetable materials. Studies on the vitamins with rats and pigeons are being carried on. Most of the feeds were found to be deficient in fat soluble A except flax and millet. In connection with the studies on nutrition, some attention was given to the subject of hairless pigs, which is considered to be a nutritional trouble. There was found to

be enlargement of the thyroid glands and a low iodine content in all the cases examined.

A project on inbreeding has been in progress with poultry. The inbred stock has practically run out, the fertility and hatchability of the eggs being very low and selection and line breeding are to be taken up within the breed to determine whether the stock can again be built up.

Various lines of work have been carried on with soils, including the availability of phosphates and studies on soil acidity, its nature, methods of measurements, and its relation to the plant. The influence on plants appears to be indirect, preventing them from getting sufficient lime for normal fruiting and growth. The nature of the root system plays an important part in the ability of plants to acquire lime and withstand soil acidity. Some experiments were conducted to determine whether liming of the soil influences acidity of the cell sap of plants. A new theory regarding the feeding process of plants has been evolved. For phosphorus nutrition, plants containing a relatively high calcium content have a relatively high power of using the phosphorus of raw phosphate rock and the converse is found to be true in plants containing a low calcium content. Similar relations have been obtained for other chemical combinations.

Cheese investigations have been carried on by the dairy department. Comparing the holder process of pasteurization in which the milk is kept at 145° F. for 20 minutes with the instantaneous flash method at 165°, no material advantage was found in the latter, which requires more expert handling. The former method gives a more perfect pasteurization.

The department of plant pathology has continued studies on cabbage diseases and a strain known as the Wisconsin Hollander, resistant to the yellows, has been developed which is being grown for distribution. The kraut type of cabbage is being studied and selections have been made that appear to possess considerable resistance. Work is in progress on the life history of the fungus producing wilt. For this purpose flax has been substituted for the cabbage, on account of the greater ease of growing it under laboratory conditions, the fusarium attacking the two plants being closely related. It is found that no development takes place as long as the soil temperature is below 60° F.

Work with Hatch and other funds.—Extensive breeding experiments with both plants and animals have been carried on in the study of inheritance and the physiology of egg production on the pigeon. With the soy bean breeding work has been carried on as to the inheritance of oil production, its amount, and chemical composition. It is found that seasonal influences affect the oil production. Breeding for high and low oil content with close pollinated plants

did not give very good results, and cross-pollination will be tried. Several groups were discovered that segregated in Mendelian ratio. The amount of natural crossing that occurs in the field is being studied with soy beans and flax.

With animals, a statistical study of freemartins is being continued, data being secured from breeders throughout the State. A study of the relation of age of dam to twin production is being made and data on multiple births in sheep and swine are being gathered. Attempts to increase the percentage of butter fat in milk were successful in one animal out of six. General observations along breeding lines are being continued, particularly on egg production, broodiness, and the restoration of eggs when taken from the nest, with pigeons, sparrows, mallards, domestic ducks, and wrens.

The dairy division has been studying leakiness in butter. This was found to be due to methods of working, temperature of the wash, churning temperature, and the quality of the fat. Investigations were made on the bacterial content of ice cream. The lowest bacterial count was found when the entire mixture had been pasteurized. Contrary to the general belief that the feeding of silage produces bloating in cheese, results showed that in no case did this result from such feeding, it being evidently due to tank infection. In one instance it was traced to yeast in the whey tank.

Studies on the effect of sulphur in plants have been carried on both in the field and greenhouse. In the field rotations of rape, clover and barley have been grown, sulphur being applied in the form of gypsum. In the greenhouse sulphur applied in this form gave some gains with legumes and crucifers, but more with cereals. Elemental sulphur gave uniformly poor results. Its effect on the bacterial activity in the soil is being studied. A biological analysis of feeds indicated that this was as important as the chemical analysis.

From experiments in feeding baby chicks for growth it was found that the addition of milk to the grain ration gave three times the growth produced by grain alone. A trial of different sources of lime for egg production showed a 30 per cent increase with clam or oyster shells over other forms.

The bacteriological department has studied the factors concerned in silage production, a method for rapid bacterial counts of milk, and the preservative action of spices. A number of specific organisms have been found associated with preserved meats, and these are being studied. Acid soils have been found to require inoculation for a growth of alfalfa or soy beans, and unless soils of this character are limed the organism does not persist long in the absence of host plants. The amounts and forms of lime best suited and the effect of lime on the plant itself are being studied to determine whether it is the base itself or some other factor which produces the observed results. In-

oculation was found to give marked variation in the response of crops on different soil types. Laboratory experiments to determine the reaction of bacteria to host and soil conditions show that lupine bacteria are best adapted to acid conditions while alfalfa bacteria are best for alkaline soils, other groups grading between these.

Among the problems engaging the attention of the animal husbandry department are experiments in feeding corn with milk and other supplements to pigs, forage crops for hog feeding, winter feeding of brood sows, and tests of various types of hog houses. Some fattening experiments with lambs were carried out, in which linseed and cottonseed meals were fed in conjunction with silage; also comparing the feeding of lambs in sheds and open pens. The winter feeding of dairy heifers to test the value of various roughages and some experiments in horse breeding are being conducted. A comparison of feeding crushed and uncrushed oats showed less than 10 per cent increase in efficiency due to crushing.

Investigations are being carried on by the entomological department on the insect pests of the cabbage, apple, and potato, and, in cooperation with the horticultural department, on spraying experiments for the control of apple insect pests. Spraying has proved beneficial against the cabbage worm, and there seems to be no danger from the use of arsenates for this purpose, as they are deposited on the outer leaves, which are discarded in preparing for market. The addition of molasses was found to give much greater adhesion.

Studies have been made of onion smut and methods for its control. Disinfection of the seed has given good results, formalin being best for the purpose. Anthracnose of onions is becoming serious in the State. While the parasite is a weak one, spraying does not seem to be effectual. It is believed that kiln drying will prevent loss of the stored bulbs. Studies have been made of cucumber diseases, the causal agent of several of them determined, and the life histories worked out. A 4:4:50 Bordeaux mixture has been found to be very efficient in controlling the cherry-leaf spot and is being generally used. Commercial lime-sulphur gave practically as good results. Proper sanitation of the orchard and plowing under old leaves is of decided benefit.

Considerable attention has been paid to diseases of barley and the means of control of some of them have been worked out. Diseases quite similar to those on barley have been observed on wheat, spelt, rye, and to some extent on timothy and quack grass, and the relation of the barley diseases to those occurring on other cereals is being studied. A number of minor problems are receiving attention, as *Rhynchosporium* disease of barley, ergot on rye, diseases of forage crops, red-clover rust, *Scoletotrichum* disease of timothy and orchard grass, a bacterial disease of the soy bean, and several alfalfa dis-

eases. Studies are being made on tobacco diseases and the relation of soil temperature to their development. In root rot the organism was found to attack plants when the soil temperature ranged from 15° to 24° C., but not at 27° or over. Root rot resistant strains have been developed. It is due to soil infection. It is believed that the common opinion that tobacco is hard on soils is due to the fact that the soil becomes infected. Some work has also been done on tobacco rust and a wilt disease.

The horticultural department has various problems under investigation, as fertilizers for cherry trees and potatoes, the differences between stock and scion as regards winterkilling, winter injury to large and small roots, and cover crops as affecting soil temperature and root development. Other studies included the effect of pruning apple trees at the time of planting, the suitable age for planting, dynamiting in connection with orchard planting, root development, factors influencing the biennial production of fruit, and the formation of fruit spurs.

Agronomy experiments included rates and times of seeding, plant breeding, the production of pedigreed strains of wheat, oats, peas, and corn, the growing and use of soy beans and Sudan grass for hay, and seed production. A considerable amount of emergency work was carried on, especially on the use of barley flour as a substitute for a portion of the wheat flour in bread, with very favorable results, the bread being considered by most people as being more palatable than whole-wheat bread.

The following publications were received from the station during the year: Bulletins 230, 2. ed., Soil Acidity and Liming; 269, Managing the Orchard; 270, The Marketing of Wisconsin Butter; 271, Rural Clubs in Wisconsin; 272, Keep Our Hillside from Washing; 273, Distribution of Public-service Stallions in Wisconsin; 274, Judging Dairy Cows; 275, The Work of the Experiment Station and Agricultural Extension Service for 1916; 276, Correct Payment for Cheese Factory Milk by the Babcock Test; 277, The Management of Tobacco Soils; 278, The Country Church—An Economic and Social Force; 279, Fertilizers Sold in Wisconsin; 280, Potato Growing in Wisconsin; Research Bulletins 39, The Gain in Nitrogen from Growth of Legumes on Acid Soils; 40, Some Economic Factors Which Influence Rural Education in Wisconsin; and 41, The Utilization of Phosphates by Agricultural Crops, Including a New Theory Regarding the Feeding Power of Plants.

The income of the station during the fiscal year was as follows:

United States appropriation, Hatch Act.....	\$15,000.00
United States appropriation, Adams Act.....	15,000.00
State appropriation	97,500.00
Fees	9,403.62
Total	136,903.62

The station is not only getting results of fundamental importance, but in many of the investigations very practical results have been secured and their wide adoption within and without the State testifies to the character of the work.

WYOMING.

Wyoming Agricultural Experiment Station, *Laramie*.

H. G. KNIGHT, A. M., *Director*.

This station entered actively into emergency work, and contributed a number of the members of its staff to the national service. The director was appointed chairman of the State council of defense. J. A. Hill, wool specialist, was granted leave of absence to serve in the National Army. A number of changes were made in the assistants in the departments of parasitology, veterinary, and wool investigations.

A chemical research laboratory was fitted up at a cost of about \$700, and an electrochemical laboratory is to be supplied for the poisonous-plant investigations at a cost of \$400. An extensive tile-drainage system has been laid out in the worst alkali portion of the stock farm at a cost of about \$1,200.

Adams fund projects.—The wool investigations were interrupted by the changes in the staff, but will be resumed as soon as practicable. A humidifier for wool testing has been installed and tests made of its accuracy and efficiency.

One of the principal lines of investigation has been on plants poisonous to sheep. The active poisonous principle of the woody aster has been isolated and studied, but not as yet definitely identified. When given to rabbits it produces all the toxic effects of the plant itself. It is a crystalline substance containing nitrogen, quite insoluble in water, and of a strong acid reaction. The acidity is closely connected with its poisonous action, as when it is neutralized the toxicity is lost. This suggested the possibility of the use of soda or other alkali as an antidote, and doses of sodium bicarbonate were found to relieve animals affected by consumption of the plant. On account of the strong caustic action of the poison, however, the remedy must be given quickly or serious results, and even death, will ensue from the breaking down of the tissues.

Three species of larkspur have been under investigation, *Delphinium geyeri*, *D. glaucum*, and *D. glucescens*. An alkaloid has been extracted from mature plants of each of the species and differences in constitution noted, which may be due to differences in the stage of growth or to water content. Young growth of *Delphinium* presents a somewhat different alkaloidal type and is supposed to be more toxic at this stage. It also seems to be more toxic after rains.

Some loss of stock was reported from feeding on the *D. geyeri* after the plant had blossomed. This is contrary to the general belief and will be investigated. Of the native lupines, *Lupinus argenteus* is regarded as the most poisonous. An alkaloidal assay calculated as lupinin showed the early pods to contain 0.4695 per cent, the late pods 0.2687 per cent, the early leaves 0.3196 per cent, and the seed 0.3346 per cent. The material was finely powdered and extracted with alcohol. The crude poison thus separated after one purification showed that of the early pods and leaves 17 milligrams per kilogram weight was the lethal dose for rabbits; of the flowers, 21 milligrams; and of the late seeds, 28 milligrams.

The statement usually made that the mature seeds are the most toxic was not borne out by the investigation. The species analyzed, *L. argenteus* and *L. parviflorus*, showed a lower percentage of alkaloids than the European lupines. About 40 head of cattle were said to have died in a case of lupine poisoning in 1910 from eating the green leaves and fruit of *L. parviflorus*. It is reported that the lupine alkaloids are easily soluble in water, but this did not prove to be the case and aqueous extracts of the plants were nontoxic. The milk vetch, *Astragalus bisulcatus*, has proved very poisonous to cattle, 80 to 90 per cent of affected animals dying, and it is also reported to be poisonous to sheep. A nonalkaloidal poison has been found in all parts of the plant, especially the leaves. This can be readily extracted from the green or dried plants by water and appears to be of the nature of a glucosid. Its effect is stimulative on the action of the heart and on the nervous system. No antidote has been found for it.

Good progress has been made in the study of the transmission of swamp fever in horses. Proof that the disease may be transmitted by the stable fly, *Stomoxys calcitrans*, was secured, but it is not yet definitely known whether this is true of other species of flies, as the *Tabanus* and *Chrysops*. The virus may be transmitted by puncturing with an infected hypodermic needle, thus demonstrating that the disease may be produced by the subcutaneous injection of very small quantities of blood and shows that the contaminated mouth parts of biting flies are capable of carrying sufficient of the virus to produce the disease. A horse may contract the disease from bites of flies and for months show very little fever and few symptoms and still carry virulent blood, which is also true after the animal has developed immunity. The failure of the mosquito to transmit the disease is believed to be due to the cleaning of the blood from the proboscis by retracting it in its sheath. A colt born to an affected mare is being kept under observation to determine whether it has been infected through its dam.

Some studies made on the broad tapeworm of sheep show that lambs are probably infected by pasturing on infected areas. Investiga-

tions on the sarcocystis parasite of sheep indicate that infection occurs during summer or early fall, that infection does not take place in utero, and that in all cases where lambs were allowed to graze, whether there was standing water or not, 100 per cent were infected.

The project on the alkali proofing of cement has yielded results that have been published, the conclusions being that cement put into solutions of alkali salts sets as well as in water, the ultimate cause of the disintegration of the cement by the alkali being due to the formation of compounds which are subsequently removed by solutions. Much of the disintegration of cement appears to be due to poor mechanical mixture and the presence of organic matter.

Work with Hatch and other funds.—Negative results have been obtained with commercial fertilizers except those containing nitrogen. The best results were obtained with organic fertilizers with all crops tried. Variety tests have been conducted with root crops and peas. A number of varieties of spring wheat are being investigated and selection is being tried in an attempt to produce an early maturing strain of the standard varieties. Difficulty has been experienced in getting a sufficient growth of corn for silage, and sunflowers are being grown for this purpose with very satisfactory results. All of the introduced trees and shrubs under trial have died except a few, as the cottonwood, which can be grown successfully anywhere in the Laramie plains. Of the alfalfa varieties tried Grimm was the only one that survived the severe winter, coming through with practically no winterkilling. Sweet clover has proved to be a valuable crop, growing in many places where other crops can not be grown.

The breeding experiments with polled Herefords have been seriously interrupted by the appearance of tuberculosis in the herd in spite of all precautions. Numerous feeding experiments are in progress. A comparison was made of maintaining cattle on the range and of feeding at the station. The steers on the range gained 1 pound each during the winter, while those feed at the station on alfalfa hay and silage gained 168 pounds each. Pea silage gave very satisfactory results, especially with young cattle, 2 pounds being about equivalent to 1 pound of alfalfa hay. Similar experiments with sheep gave the best gains with a lot fed grain and alfalfa hay. About equal economic gains were made where silage was substituted for half the hay. The lot that was fed silage and grain fattened more slowly but gave satisfactory increases. It was found that swine eat more and made more rapid gains when their feed was cooked.

Studies on the relation of plant composition to soil composition, especially with regard to the nitrogen content, have not indicated any direct relation. Observations on the durability of wire screens have been begun in cooperation with the Bureau of Entomology, United States Department of Agriculture. Screens of different

grades, manufacture, and texture have been placed where they will be fully exposed to all weathers and observations will be made on them periodically.

The following publications were received from this station during the year: Bulletins 110, Sweet Clover; 111, Alfalfa in Wyoming; and the Annual Report for 1916.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act-----	\$15,000.00
United States appropriation, Adams Act-----	15,000.00
Sales, balance from previous year-----	725.23
Miscellaneous-----	1,788.11
Total-----	32,513.34

The work of the Wyoming station is of relatively high order and the organization very satisfactory. The policy is to concentrate upon more important problems rather than to cover a wide field. The station is hampered by lack of any State appropriation and is in need of more funds to attain its highest usefulness to the State.

STATISTICS OF THE AGRICULTURAL EXPERIMENT STATIONS.

During the fiscal year ended June 30, 1917, the total income of the experiment stations, including the stations in Alaska, Hawaii, Porto Rico, and Guam, was \$5,642,149.16. Of this amount \$718,744 was derived under the Hatch Act, \$718,358.04 under the Adams Act, \$143,000 from the Federal appropriations for the insular stations, \$2,322,335.65 from State appropriations, \$30,764.78 from individuals and communities, \$365,552.53 from fees, \$696,108.33 from the sale of products, and \$644,387.87 from miscellaneous sources.

The value of additions to the equipment of the stations during the year was estimated as follows:

Buildings-----	\$318,500.59
Libraries-----	22,820.10
Apparatus-----	62,533.74
Farm implements-----	101,343.54
Live stock-----	176,067.66
Miscellaneous-----	69,932.70
Total-----	751,198.33

The stations employed 1,955 persons in the work of administration and inquiry. Of this number 950 were also members of the teaching staff of the colleges, and 691 assisted in the various lines of extension work. During the year the stations published 1,624 annual reports, bulletins, and circulars, aggregating 28,109 pages, and these were distributed to 1,130,219 addresses on the regular mailing list.

The statistics of the stations by States are given in detail in the tables following

Station.	Location.	Director.	Date of original organization.	Date of organization under Hatch Act.	Number on staff.	Number of teachers on staff.	Number of persons on staff who assist in extension work.	Publications during fiscal year 1916-17.		Number of names on mailing list.
								Number.	Pages.	
Alabama (College).....	Anniston.....	J. F. Dugger.....	Feb. —, 1883	Feb. 24, 1888	25	12	19	15	210	28, 000
Alabama (Canebrake).....	Uniontown.....	L. H. Moore.....	Jan. 1, 1886	Apr. 1, 1888	13					
Alabama.....	Tuskegee Institute.....	G. W. Carver.....	Feb. 13, 1897		7					
Alaska.....	Sitka.....	C. C. Georgeson.....	1889		16	9	5	2	130	3, 700
Arizona.....	Tucson.....	R. H. Forbes.....	1887		19	17	10	10	317	12, 000
Arkansas.....	Fayetteville.....	Martin Nelson.....	1875		125	91	112	39	148	36, 000
California.....	Berkeley.....	T. F. Hunt.....	Mar. —, 1888		32	32	13	12	912	35, 790
Colorado.....	Fort Collins.....	C. P. Gillette.....	Feb. 29, 1888		19	6	6	4	456	9, 000
Connecticut (State).....	New Haven.....	E. H. Jenkins.....	Oct. 1, 1875		10	6	5	5	274	11, 000
Connecticut (Storrs).....	Storrs.....	do.....	do.....		11	6	5	5	251	7, 000
Delaware.....	Newark.....	Harry Hayward.....	Feb. 21, 1888		16	1	8	78	462	15, 500
Florida.....	Gainesville.....	P. H. Rolfs.....	1888		7		5	7	132	14, 470
Georgia.....	Experiment.....	J. D. Price.....	Feb. 18, 1888		8		8	1	43	
Guam.....	Guam.....	A. C. Hartenbower.....								
Hawaii.....	Honolulu.....	J. M. Westgate.....			27	20	11	10	324	12, 500
Idaho.....	Moscow.....	J. S. Jones.....	Feb. 26, 1892		99	72	40	33	761	41, 000
Illinois.....	Urbana.....	Eugene Davenport.....	Mar. 21, 1888		62	14	7	24	1, 178	43, 000
Indiana.....	Lafayette.....	Arthur Goss.....	Jan. —, 1888		55	22	26	26	536	36, 922
Iowa.....	Ames.....	C. F. Curtis.....	Feb. 17, 1888		79	31	49	15	368	22, 130
Kansas.....	Manhattan.....	W. M. Jardine.....	Feb. 8, 1888		51	19	9	8	495	20, 000
Kentucky.....	Lexington.....	A. M. Peter I.....	Sept. —, 1885		28	2	5	5	206	10, 000
Louisiana (Sugar).....	New Orleans.....	W. R. Dodson.....	Apr. —, 1886		23					
Louisiana (State).....	Patou Rouge.....	May —, 1887			22	3		17	198	10, 000
Louisiana (North).....	Calhoun.....	Mar. —, 1885			39	16	12	12	354	20, 000
Maine.....	Orono.....	C. D. Woods.....	1888		42	16	16	16	611	27, 901
Maryland.....	College Park.....	H. J. Patterson.....	1882 ²		95	57	2	15	789	45, 000
Massachusetts.....	Amherst.....	W. P. Brooks.....	1882 ²		22	6	8	4	662	7, 600
Michigan.....	East Lansing.....	R. S. Shaw.....	Mar. 7, 1885		22	50	28	217	1, 778	12, 969
Minnesota.....	Agricultural College.....	A. F. Woods.....	Mar. 7, 1885		3					
Mississippi.....	University Farm.....	E. R. Lloyd.....			28	12	11	17	317	15, 000
Missouri (College).....	Columbia.....	F. B. Mumford.....	Feb. 1, 1900		30	18	10	12	538	22, 000
Missouri (Fruit).....	Mountain Grove.....	Paul Evans.....	Dec. 16, 1884		15	4	2	6	160	3, 000
Montana.....	Bozeman.....	E. B. Linfield.....	1886		22	12	12	8	136	16, 000
Nebraska.....	Lincoln.....	S. A. Burnett.....	1886		36	17	23	190	1, 479	10, 000
Nevada.....	Reno.....	E. B. Doten.....								
New Hampshire.....	Durham.....	J. C. Kendall.....								
New Jersey (State).....	New Brunswick.....	J. G. Lipman.....	Mar. 10, 1880							

State	College	Faculty	Year	Age	Sex	Religion	Marital Status	Children	Spouse	Parents	Other	Total
New Jersey	College	do	Apr. 26, 1888	18	6	5	2	298	10,000			
New Mexico	do	Fabian Garcia	Dec. 14, 1889	38	17	8	50	292	12,000			
New York	Agricultural College	W. H. Jordan	Mar. —, 1882	38			33	1,406	49,315			
New York	Geneva	A. R. Mann	1879	53	45	24	339	1,934	45,000			
New York	Ithaca	B. W. Kilgore	Mar. 12, 1877	57	8	6	20	326	50,000			
North Carolina	West Raleigh	T. P. Cooper	Mar. —, 1890	73		6	12	860	4,800			
North Carolina	Agricultural College	C. E. Thorne	Apr. 25, 1882	73	2	20	82	1,408	65,000			
Ohio	Wooster	W. L. Carlyle	Dec. 25, 1890	17	13			205	13,596			
Oklahoma	Stillwater	A. B. Cordley	July —, 1888	40	33	16	7	245	30,000			
Oregon	Corvallis	R. L. Wadsworth	June 30, 1887	69	54	69	5	612	30,000			
Pennsylvania	State College	H. P. Armsby	1907	8			4	82	160			
Pennsylvania	do	D. W. May		12		2	6	164	2,550			
Porto Rico	Mayaguez	B. L. Hartwell	July 30, 1888	7		5	204	2,000	2,000			
Rhode Island	Kingston	H. W. Barre	Jan. —, 1888	20	15	8	15	166	20,000			
South Carolina	Clemson College	J. W. Wilson	Mar. 13, 1887	18	14	4	8	259	23,000			
South Dakota	Brookings	H. A. Morgan	Aug. 4, 1887	23	6		6	189	9,500			
Tennessee	Knoxville	B. Youngblood	Apr. 3, 1889	45	5		28	1,005	45,000			
Texas	College Station	F. S. Harris	Apr. —, 1890	23	31	18	18	523	12,000			
Texas	Logan	J. L. Hills	Feb. 28, 1888	18	10	3	10	462	13,000			
Utah	Burlington	A. W. Drinkard, Jr.	Nov. 24, 1886	23	10	1	4	167	12,000			
Vermont	Blacksburg	T. C. Johnson	1888	7	1	3	5	119	7,500			
Virginia	Norfolk	George Severance	1891	32	5	9	27	930	25,705			
Washington	Pullman	J. L. Coulter	June 11, 1888	37	17	18	13	342	16,000			
West Virginia	Morgantown	H. L. Russell	1887	106	82	31	41	929	32,011			
Wisconsin	Madison	do	1883	12	11	7	5	159	10,000			
Wyoming	Laramie	do	Mar. 1, 1891	12	11	7	5	159	10,000			
Total				1,955	950	691	1,624	28,109	1,130,219			

¹ Acting director.

In 1882 the State organized a station here and maintained it until June 18, 1895, when it was combined with the Hatch station at the same place.

	Station.	Federal.		State.	Individuals and communities.	Fees.	Sales.	Miscellaneous. ¹
		Hatch fund.	Adams fund.					
1	Alabama (College).	\$15,000.00	\$15,000.00	\$27,000.00			\$648.24	\$5,261.10
2	Alabama (Canebrake).							
3	Alabama (Tuskegee).							
4	Alaska							2,451.20
5	Arizona	15,000.00	15,000.00	30,420.73			11,419.09	5,642.19
6	Arkansas	15,000.00	15,000.00	24,500.00		\$1,104.70	840.25	20,228.20
7	California	15,000.00	15,000.00	120,281.18	\$575.00	6,862.91	43,615.29	37,243.71
8	Colorado	15,000.00	15,000.00	36,542.55			476.15	16,842.28
9	Connecticut (State)	7,500.00	7,500.00	24,000.00	7,711.00	9,597.25		4,614.40
10	Connecticut (Storrs)	7,500.00	7,500.00	4,500.00				8,572.28
11	Delaware	15,000.00	15,000.00	10,000.00			15,380.15	
12	Florida	15,000.00	15,000.00	8,077.22			3,604.61	3,360.07
13	Georgia	15,000.00	15,000.00	747.76			2,435.04	2,886.57
14	Guam							474.54
15	Hawaii			3,000.00	921.25			1,654.20
16	Idaho	15,000.00	15,000.00				8,000.35	2,227.32
17	Illinois	15,000.00	15,000.00	195,500.00			53,263.30	17,762.64
18	Indiana	15,000.00	15,000.00	91,000.00	9,390.88	72,974.53		205,230.91
19	Iowa	15,000.00	15,000.00	105,880.05			33,343.30	16,056.83
20	Kansas	15,000.00	15,000.00	80,302.61		54,122.66		
21	Kentucky	15,000.00	15,000.00	82,490.92		68,685.35	55,992.77	19,673.22
22	Louisiana	15,000.00	15,000.00	25,500.00		13,266.19	4,016.97	1,447.70
23	Maine	15,000.00	15,000.00	14,105.42		12,755.14	14,013.75	
24	Maryland	15,000.00	15,000.00	33,375.00		20,948.81	20,948.81	3,552.22
25	Massachusetts	15,000.00	15,000.00	38,500.00		9,641.81	10,903.08	28,778.29
26	Michigan	15,000.00	15,000.00	22,000.00		16,807.26	4,779.18	7,304.48
27	Minnesota	15,000.00	15,000.00	128,376.37			79,040.64	902.80
28	Mississippi	15,000.00	15,000.00	35,425.00		490.00	17,367.27	7,185.26
29	Missouri (College)	15,000.00	15,000.00	21,533.26		21,019.13	14,356.57	28,190.35
30	Missouri (Fruit)							
31	Montana	15,000.00	15,000.00	66,000.00	2,000.00		8,000.00	
32	Nebraska	15,000.00	15,000.00	29,185.00			60,950.36	29,549.84
33	Nevada	15,000.00	15,000.00	3,768.81			1,753.06	749.76
34	New Hampshire	15,000.00	15,000.00				2,414.74	8,528.37
35	New Jersey (State)			98,400.00		42,403.40	26,802.19	
36	New Jersey (College)	15,000.00	15,000.00					
37	New Mexico	15,000.00	15,000.00	5,346.15	125.00		5,992.31	9,900.01
38	New York (State)	15,000.00	15,000.00	126,098.22			8,395.05	8,395.05
39	New York (Cornell)	13,500.00	13,500.00					
40	North Carolina	15,000.00	15,000.00	89,490.51			5,387.20	2,623.13
41	North Dakota	15,000.00	15,000.00	51,799.40			31,465.96	1,914.92
42	Ohio	15,000.00	15,000.00	269,313.20			31,193.38	53,372.68
43	Oklahoma	15,000.00	15,000.00	5,154.26			5,661.09	3,404.76
44	Oregon	15,000.00	15,000.00	31,000.00	2,000.00		11,829.75	31,690.73
45	Pennsylvania	15,000.00	15,000.00			7,100.36	22,029.96	4,336.50
46	Pennsylvania (Nutrition)							
47	Porto Rico						753.41	1,313.69
48	Rhode Island	15,000.00	15,000.00					7,304.86
49	South Carolina	15,000.00	15,000.00	7,154.41			2,395.89	21.31
50	South Dakota	15,000.00	15,000.00	12,000.00			5,387.62	11,962.14
51	Tennessee	15,000.00	15,000.00	23,575.86			12,010.04	
52	Texas	15,000.00	15,000.00	135,000.00			25,780.57	4,028.66
53	Utah	15,000.00	15,000.00	13,464.55			9,123.14	128.02
54	Vermont	15,000.00	15,000.00	1,000.00	5,395.08	2,996.75		
55	Virginia	15,000.00	15,000.00	21,062.51			7,233.01	7,390.08
56	Virginia (Truck)							
57	Washington	15,000.00	15,000.00	33,964.70	2,646.57		17,956.69	6,521.35
58	West Virginia	15,000.00	15,000.00	20,000.00		16,321.47	7,449.55	1,165.91
59	Wisconsin	15,000.00	15,000.00	97,500.00		9,403.62		
60	Wyoming	15,000.00	15,000.00					2,513.34
Total		720,000.00	720,000.00	2,322,335.65	30,764.78	365,552.53	696,108.33	644,387.87

¹ Including all balances except from Federal funds.

Including balances from previous year: Alabama, \$242.92; Arizona, \$0.05 Hatch, \$4.39 Adams; Delaware, \$1,000 Hatch, \$975 Adams; Maryland, \$527.51; Missouri, \$0.10; New York (State), \$13.03 Hatch, \$134.93 Adams

to equipment, 1916-17.

Total.	Additions to equipment.							
	Buildings.	Library.	Apparatus.	Farm im- plements.	Live stock.	Miscella- neous.	Total.	
\$62,909.34	\$250.00	\$360.00	\$850.00	\$350.00	\$275.00	\$800.00	\$2,885.00	1
								2
								3
50,451.20	5,056.17	10.00		1,722.97	795.00	1,313.23	8,897.37	4
77,482.01	7,670.75	39.84	1,612.04	4,219.17	1,605.34	5,103.17	20,250.31	5
76,673.15	1,961.26	328.79	2,021.63	524.00	2,579.00	632.80	8,047.48	6
238,578.09	131,550.79	2,679.04	2,877.14	11,228.08	7,417.75	8,184.13	163,936.93	7
83,860.98	3,266.44	233.20	554.28	3,772.61	375.00	352.00	8,553.53	8
60,922.65	168.03	532.21	292.29	842.10		760.56	2,595.19	9
28,072.28	116.44	66.40	107.53	45.77	26.00	272.18	634.32	10
55,380.15		332.92	2,207.77	1,242.23	2,522.65	2,758.77	9,064.34	11
45,041.00	1,855.52	378.84	907.15	553.92	1,264.50	1,149.01	6,108.94	12
36,069.37	3,120.31	250.85	248.18	480.22	1,117.53	249.87	5,466.96	13
15,474.54								14
45,375.45	141.74	379.33	148.18	584.26	185.00	120.26	1,558.77	15
40,287.67	1,437.16	183.70	1,217.88	2,085.36	918.85	491.86	6,334.81	16
290,525.94	1,829.79	446.06	2,755.21	8,230.92	6,134.48	1,902.13	21,298.59	17
408,596.32	12,625.52	1,071.86	2,337.91	3,101.15	51,286.28	3,234.38	73,637.10	18
185,280.18	1,500.00		966.83	1,607.14	4,748.90	572.25	9,395.12	19
164,425.27	7,741.34	394.29	608.92	6,547.66	3,416.98		18,709.19	20
258,842.26	21,450.00	150.00	900.00	1,800.00		500.00	24,800.00	21
74,230.86	4,237.81	208.08	2,141.68	2,772.50	3,550.35		12,905.42	22
70,874.31		250.00	225.00	650.00			1,125.00	23
87,876.03		440.66	2,438.26	2,116.25	1,007.25		6,000.42	24
117,823.18	60.97	685.23	546.74	787.95	446.20		2,527.09	25
80,800.92	274.71	579.75	1,646.68	783.30			3,374.44	26
238,319.81	1,245.51	947.40	1,100.93	3,514.96	2,505.16	2,081.85	11,395.81	27
90,467.53	3,250.00	33.30	92.29	1,288.00	19,874.26	3,306.60	27,844.45	28
115,099.31	1,225.59	39.50	1,288.22	1,111.53	4,827.26	877.07	9,369.17	29
								30
106,000.00	8,243.64	363.22	889.12	3,844.72	4,332.93	446.00	18,119.63	31
159,685.20	2,851.84	167.28	2,667.53	1,297.69	7,081.85	257.81	14,324.00	32
36,271.63	828.13	221.11	395.82	1,154.20	1,165.08	254.80	4,019.14	33
40,943.11		225.00	54.66				279.66	34
167,605.59	3,000.00	500.00	2,500.00	1,000.00	4,000.00	4,500.00	15,500.00	35
30,000.00	1,000.00	20.00	180.00	140.00		200.00	1,540.00	36
51,363.47	806.80	48.72	285.00	1,005.00		470.00	2,615.52	37
147,493.27		900.00	3,016.87	750.00	550.00		5,216.87	38
27,000.00	318.94	1,649.91	2,353.00	835.33	36.40	438.59	5,632.17	39
127,500.84	5,246.02	250.00	245.90	200.00	254.55	20.00	6,216.47	40
114,210.28	1,175.10	89.89	205.66	2,158.59	7,435.70		11,064.94	41
383,882.26	4,960.41	1,229.67	4,196.55	482.00	1,937.52	17,411.56	30,217.71	42
44,220.11	2,717.52	747.55	819.64	1,072.06	463.25	351.30	6,171.32	43
106,520.48	6,227.46	71.34	418.90	1,718.80	4,383.03		12,819.50	44
63,466.82		100.00	369.49	1,347.90	6,079.00		7,896.39	45
							251.66	46
42,067.10		190.65	303.81	593.36	150.00	1,287.95	2,525.77	47
37,301.86	100.00	575.00	750.00	350.00	725.00	450.00	2,950.00	48
39,571.61	200.00	200.00	800.00	100.00		600.00	1,900.00	49
59,349.76	1,003.00	48.00	275.00	1,200.00	1,870.00	220.00	4,622.00	50
65,615.90	810.00	509.00	1,032.52	725.14	666.00	400.30	4,142.96	51
194,809.23	28,008.07	544.61	761.79	9,162.40	9,803.47	5,373.37	53,565.71	52
52,716.01	330.65	419.57	444.81	1,198.43	963.16	606.07	3,962.69	53
39,391.83	420.90	188.32	647.92		1,008.25		2,265.39	54
65,685.60	1,292.53	249.58	268.95	527.48	570.00		2,908.54	55
	400.00	68.69	113.46	342.00	175.00		1,099.15	56
91,089.31	12,509.21	322.43	801.28	2,692.87	208.45	396.44	16,930.68	57
74,937.23	9,000.00	750.00	2,500.00	500.00	1,800.00		14,750.00	58
136,903.62	13,617.52	1,131.20	3,462.78	3,787.92	3,246.31	1,384.39	26,630.12	59
32,513.31	1,400.00	113.11	1,682.54	1,105.60	275.00		4,576.25	60
5,642,149.16	318,500.59	22,820.10	62,533.74	101,343.54	176,067.66	69,932.70	751,198.33	

Including Federal appropriations: Alaska, \$48,000; Guam, \$15,000; Hawaii, \$40,000; Porto Rico, \$40,000.

Territorial.

Expenditures from United States appropriation received under the act of Mar. 2, 1887 (Hatch Act), for the year ended June 30, 1917.

Station.	Amount of appropriation.	Classified expenditures.								
		Salaries.	Labor.	Publications.	Postage and stationery.	Freight and express.	Heat, light, and water.	Chemicals and laboratory supplies.	Seeds, plants, and sundry supplies.	Fertilizers.
Alabama.....	\$15,000.00	\$7,437.35	\$1,996.02	\$1,229.77	\$214.46	\$268.43	\$464.70	\$22.13	\$431.96	\$491.92
Arizona.....	15,000.00	9,801.38	2,906.24	3.55	505.94	43.45		255.41	79.79	37.25
Arkansas.....	15,000.00	8,876.78	1,218.71	646.62	363.22	412.86	52.97	88.01	739.94	101.40
California.....	15,000.00	14,159.93	840.07							
Colorado.....	15,000.00	10,607.37	1,256.63	784.47	275.45	28.88		141.45	100.72	
Connecticut (State).....	7,500.00	7,176.00	324.00							
Connecticut (Storrs).....	7,500.00	7,431.10	41.98						2.62	
Delaware.....	15,000.00	6,953.20	1,605.50	2,530.43	645.06	72.00	98.55	285.56	310.79	265.33
Florida.....	15,000.00	7,485.00	2,931.53	934.03	748.61	190.61	109.51	110.00	184.50	27.00
Georgia.....	15,000.00	7,523.48	1,943.19	1,157.80	457.88	87.85	399.80	8.00	233.87	731.90
Idaho.....	15,000.00	9,333.76	2,595.74	245.69	281.50	69.55	29.70	170.56	287.93	75
Illinois.....	15,000.00	13,107.64	670.00	1,092.85	54.00	5.13				
Indiana.....	15,000.00	10,927.98	1,645.38	17.27	17.27				1.90	
Iowa.....	15,000.00	7,800.00	621.04	1,350.00	90.38	.45	31.08	101.63	1,247.58	89.15
Kansas.....	15,000.00	7,874.98	5,364.52	109.35	35.32	4.45	15.10	83.37	308.60	13.50
Kentucky.....	15,000.00	10,423.36	819.81	655.37	593.48	77.23	478.93	210.72	269.67	
Louisiana.....	15,000.00	7,464.88	2,474.82	1,183.66	23.51	100.67	16.08		275.07	32.00
Maine.....	15,000.00	5,919.07	3,043.85	1,156.30	759.69	156.53	630.20	1.65	573.83	191.10
Maryland.....	15,000.00	11,399.49	1,041.88	1,119.26	7.63	9.50	263.05	321.29	108.37	
Massachusetts.....	15,000.00	15,000.00								
Michigan.....	15,000.00	9,234.80	1,657.80	21.08	111.71	33.18	252.80	865.08	393.24	273.2
Minnesota.....	15,000.00	10,300.00	4,617.78		55.88	114.85	58.21		10.60	
Mississippi.....	15,000.00	9,122.47	2,208.83	739.46	143.04		7.29	79.40	432.43	
Missouri.....	15,000.00	11,962.56	1,113.80	341.25	48.73	55.86	113.66	367.93	200.27	76.19
Montana.....	15,000.00	9,325.82	4,404.80					142.60	51.19	
Nebraska.....	15,000.00	9,141.31	1,510.40	1,988.86	523.35			224.39	249.10	
Nevada.....	15,000.00	9,106.55	1,974.27	433.82	293.99	79.15	149.70	30.61	198.15	171.50
New Hampshire.....	15,000.00	10,045.27	1,205.74	692.87	761.88	471.50	694.47	433.25	312.81	8.68
New Jersey.....	15,000.00	10,038.82	981.12	364.40	556.16	15.40	242.50	56.94	431.46	236.38
New Mexico.....	15,000.00	5,782.57	2,605.85	1,556.95	218.51	113.46	120.71			59.05
New York.....	15,000.00	849.92	350.92					173.89	677.35	64.65
New York (State).....	15,000.00	5,891.55	4,663.98		108.52	100.47		164.80	539.81	567.57
New York (Cornell).....	15,000.00	7,540.00	3,457.84		283.55	94.51	236.43	104.80	13.20	
North Carolina.....	15,000.00	14,830.53	3.50					1,181.78	161.02	
North Dakota.....	15,000.00									
Ohio.....	15,000.00	6,418.35	1,744.81	165.00	4.09				321.17	17.65
Oklahoma.....	15,000.00	8,318.17	1,987.03	267.86	287.37	25.37	190.89	170.60	617.08	
Oregon.....	15,000.00	7,307.49	2,139.00	915.97	283.75	86.34	21.19		331.17	100.79
Pennsylvania.....	15,000.00	8,861.10	1,686.24	2,271.75	111.60	124.60	2.80	81.00	118.46	100.79
Rhode Island.....	15,000.00	5,951.49	3,653.68	1,505.93	164.85	140.50	160.88	33.69	893.57	993.15

Station.	Classified expenditures—Continued.									
	Feeding stuffs.	Library.	Tools, im- plements, and ma- chinery.	Furniture and fixtures.	Scientific apparatus and speci- mens.	Live stock.	Traveling expenses.	Contingent expenses.	Buildings and repairs.	Balances.
South Carolina.....	15,000.00	6,052.16	4,246.95	602.40	237.13	234.32	92.87	11.56	11.56	743.20
South Dakota.....	15,000.00	7,221.66	2,288.24	3,052.61	125.61	56.54	25.42	275.08	403.55	20.25
Tennessee.....	15,000.00	9,622.50	1,930.95	223.56	352.76	224.81	473.57	117.36	498.17	1.20
Texas.....	15,000.00	11,068.03	2,382.89	223.56	82.66	80.47	77.64	106.31	137.29	.....
Utah.....	15,000.00	7,017.94	2,141.73	48.39	677.74	3.05	226.66	480.07	511.70	111.75
Vermont.....	15,000.00	8,507.92	2,326.73	117.19	338.76	65.75	920.84	352.99	332.00	126.16
Virginia.....	15,000.00	8,965.96	2,432.36	437.44	387.55	138.31	138.58	29.59	452.88	498.32
Washington.....	15,000.00	6,932.05	3,799.86	1,731.12	399.14	14.80	90.65	36.94	572.44	.....
West Virginia.....	15,000.00	11,477.79	2,247.35	589.86	36.39	4.90	.....	522.62	149.46	86.04
Wisconsin.....	15,000.00	10,351.66	588.47	1,350.30	178.84	26.17	.....	87.01	719.49	481.35
Wyoming.....	15,000.00	8,262.76	2,679.67	1,350.30	178.84	21.32	91.26	.....	196.12	.....
Total.....	720,000.00	442,716.95	102,408.04	32,977.22	11,846.96	3,856.92	6,978.69	7,833.77	15,457.63	6,638.41
Station.	Classified expenditures—Continued.									
	Feeding stuffs.	Library.	Tools, im- plements, and ma- chinery.	Furniture and fixtures.	Scientific apparatus and speci- mens.	Live stock.	Traveling expenses.	Contingent expenses.	Buildings and repairs.	Balances.
Alabama.....	\$82.97	\$335.27	\$339.50	\$311.10	\$0.80	\$24.30	\$218.31	\$20.00	\$511.01	.....
Arizona.....	9.00	8.75	104.56	553.74	354.73	.....	473.14	23.35	388.02	.....
Arkansas.....	233.65	17.81	165.65	469.08	16.73	689.50	742.95	20.00	372.69	.....
California.....	.....	.....	334.19	197.22	.....	300.00	404.66	84.81	698.93	.....
Colorado.....	4.25	264.82	333.10	353.80	28.46	.....	331.98	20.00	36.10	.....
Connecticut (State).....	.....	.....	12.17	.....	281.03	.....	38.21	20.00	.....	.....
Connecticut (Storrs).....	.....	2.00	.....	.....	.....	.....	919.15	20.00	41.95	.....
Delaware.....	6.37	208.28	104.56	553.74	1,168.67	.....	163.36	25.00	.....	.....
Florida.....	1,221.78	291.17	165.65	469.08	.....	.....	.....	20.00	81.53	.....
Georgia.....	330.22	46.20	334.19	197.22	.....	300.00	404.66	84.81	698.93	.....
Idaho.....	820.13	11.25	333.10	353.80	28.46	.....	331.98	20.00	36.10	.....
Illinois.....	.....	.....	12.17	.....	.....	.....	38.21	20.00	.....	.....
Indiana.....	2,384.22	.....	.....	.....	.....	.....	23.25	20.00	50.73	.....
Iowa.....	3,300.00	.....	155.87	.....	136.80	.....	6.29	20.00	79.85	.....
Kansas.....	284.28	130.20	167.13	114.68	113.01	1.25	242.58	59.08	10.25	.....
Kentucky.....	.....	540.31	26.45	319.91	116.31	.....	431.95	20.00	696.27	.....
Louisiana.....	2,354.49	28.97	289.84	59.74	.....	.....	515.57	40.00	391.91	.....
Maine.....	1,946.45	230.22	268.92	80.29	74.42	.....	4.20	40.00	69.18	.....
Maryland.....	.....	23.94	12.04	37.28	582.89	.....	.....	.....	.....	.....
Massachusetts.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Michigan.....	.....	535.49	160.46	29.80	403.75	27.80	979.81	20.00	.....	.....
Minnesota.....	.....	.....	420.34	.....	.....	2,035.41	.....	.....	224.70	.....
Mississippi.....	9.25	.....	11.82	20.80	59.30	27.75	.....	.....	78.03	.....
Missouri.....	722.63	37.46	27.60	31.78	46.05	.....	246.05	.....	3.25	.....
Montana.....	14.55	.....	.....	.....	.....	.....	.....	.....	.....	.....

† Including balances, as follows: Alabama, \$242.92; Arizona, \$0.05; Delaware, \$1,000; New York (State), \$13.03.

Expenditures from United States appropriation received under the act of Mar. 2, 1887 (Hatch Act), for the year ended June 30, 1917—Continued.

Classified expenditures—Continued.										
Station.	Feeding stuffs.	Library.	Tools, im- plements, and ma- chinery.	Furniture and fixtures.	Scientific apparatus and speci- mens.	Live stock.	Traveling expenses.	Contingent expenses.	Buildings and repairs.	Balances.
Nebraska.....	\$993.08	\$27.25	\$48.69	\$16.10	\$437.26	\$105.00	\$31.01			
Nevada.....	221.93	173.11	672.52		13.55	115.20	592.96	\$21.60	\$662.06	
New Hampshire.....	101.47	225.00	48.78		54.66		269.72	20.00	8.38	
New Jersey.....		20.03	107.60	77.70	35.98		999.84	40.14	705.57	
New Mexico.....	1,754.81	37.59	960.89	334.76		400.00	346.28	20.00	22.84	
New York (State).....							209.88			\$21.23
New York (Cornell).....		14.12	604.23	122.40	272.24		531.16		275.44	
North Carolina.....	658.10	100.00	206.00		27.25	146.50	218.12	20.00	746.02	
North Dakota.....					52.77	100.00				
Ohio.....	2,390.76	19.61	112.43	120.36		189.38			740.00	
Oklahoma.....	687.75	540.40	458.02	201.60	1,142.41		481.50	21.00	746.98	
Oregon.....	1,435.22	61.00	265.52	103.62	168.98		1,365.47	20.00	55.56	
Pennsylvania.....	430.48	257.31	266.10		47.45	183.00	550.21		87.56	
Rhode Island.....	574.28	338.70	71.46	1.00	6.70			20.00	139.99	
South Carolina.....	904.57	55.83	187.40	149.09			247.02	20.00	604.90	
South Dakota.....	431.15		706.61	124.41	8.10		133.72	20.00	101.05	
Tennessee.....	666.80	235.59	390.35	70.37	.95		45.75	20.00	125.31	
Texas.....	29.45	30.02	292.69	37.00	9.62	24.00	365.05	20.00	246.88	
Utah.....	1,662.29	273.63	522.45	220.25	134.19	100.04	754.55	20.00	81.65	
Vermont.....	1484.78	167.70	140.22	65.88	434.55		367.73	20.00	140.78	
Virginia.....	282.75	173.55	476.43	94.43		171.15	234.92	40.00	3.58	
Washington.....		119.05	187.84	78.73	62.73		853.65	20.00	61.00	
West Virginia.....			57.66				976.80		19.10	
Wisconsin.....	70.35		197.45	275.63	260.38	100.00	761.08		141.67	
Wyoming.....	1,119.59	9.52	354.98	28.50	23.36	325.00	129.80			
Total.....	29,973.75	5,611.45	10,398.30	5,022.70	6,576.08	5,065.28	16,256.68	794.98	9,482.72	103.45

Expenditures from United States appropriation received under the act of Mar. 16, 1906 (*Adams Act*), for the year ended June 30, 1917.

Classified expenditures.

Station.	Amount of appropriation.	Salaries.	Labor.	Postage and stationery.	Freight and express.	Heat, light, and water.	Chemicals and laboratory supplies.	Seeds, plants, and sundry supplies.	Fertilizers.
Alabama.....	\$15,000.00	\$10,183.69	\$1,540.38	\$109.37	\$214.78	\$294.20	\$133.08	\$137.56	\$150.25
Arizona.....	15,000.00	10,327.59	639.89	79.16	86.01		57.88	195.13	10.94
Arkansas.....	15,000.00	9,949.62	1,637.16	121.52	169.97	305.43	641.61	300.57	22.00
California.....	15,000.00	11,097.55	1,283.87	14.19	5.28	9.12	932.12	163.14	
Colorado.....	13,139.95	398.72	139.49	19.60	129.02		149.80	140.24	
Connecticut (State).....	7,500.00	5,629.49	251.29	69.48	52.34	457.16	265.39	216.82	76.27
Connecticut (Storrs).....	7,500.00	5,139.42	755.42	1.02	1.46	25.30	50.95	198.75	
Delaware.....	10,267.94	780.53	1,170.57	50.27	60.30	129.70	1,883.77	156.57	96.60
Florida.....	15,000.00	10,122.46	1,480.70	77.14	158.90	85.65	745.93	313.12	124.69
Georgia.....	15,000.00	10,152.59	1,955.09	40.90	75.23	530.19	864.19	184.93	
Idaho.....	15,000.00	8,999.24	1,480.70	43.70	515.64	57.79	804.90	467.73	
Illinois.....	15,000.00	10,228.04	2,342.80	121.04	16.01		568.40	121.26	
Indiana.....	15,000.00	12,606.70	388.34	18.91	74		294.80	13.73	
Iowa.....	15,000.00	9,203.88	2,068.81	1.50	14.01	144.96	1,126.91	238.97	48.65
Kansas.....	15,000.00	7,441.62	2,808.93	45.64	36.54	105.24	772.42	284.21	
Kentucky.....	15,000.00	12,815.27	919.06	10.24	12.99	121.02	150.77	106.60	
Louisiana.....	15,000.00	10,814.26	438.70	30.28	28.38	165.32	254.89	254.89	
Maine.....	15,000.00	11,364.40	44.65	116.24	118.51	108.33	26.43	260.02	
Maryland.....	15,000.00	10,950.78	424.30	1.87		233.94	1,181.57	503.20	
Massachusetts.....	15,000.00	15,000.00			.69		624.46	193.50	
Michigan.....	15,000.00	9,883.20	2,169.59	17.22					
Minnesota.....	15,000.00	14,511.87	488.13		13.37		49.39	11.03	
Mississippi.....	15,000.00	8,941.57	4,229.43	19.45	106.00	38.23	370.20	668.96	9.97
Missouri.....	15,000.00	6,233.40	3,219.33	27.65	43.64	50.88	383.41	69.09	
Montana.....	15,000.00	9,892.48	3,314.34	34.94	11.03		584.35	392.56	
Nebraska.....	15,000.00	12,461.93	128.48			168.32	69.97	283.31	
Nevada.....	15,000.00	9,015.46	2,236.48	116.16	49.38		125.19	287.92	225.45
New Hampshire.....	15,000.00	10,395.01	2,283.16	3.83	97.41	7.55	782.44	161.61	85.30
New Jersey.....	15,000.00	11,930.01	637.76	35.70	5.51	252.83	841.55	374.45	16.49
New Mexico.....	15,000.00	8,649.82	2,025.53	65.52	383.57	407.63			
New York (State).....	11,500.00	1,499.84							
New York (State).....	13,500.00	9,203.00	2,700.89	26.80			617.43	275.24	3.50
New York (Cornell).....	15,000.00	12,423.06	438.74	169.77	67.32	172.14	416.35	228.11	120.35
North Carolina.....	15,000.00	10,961.45	25.91	25.91	61.70		414.92	187.89	
North Dakota.....	15,000.00	7,406.02	2,851.10	29.01			1,219.00	34.20	
Ohio.....	15,000.00	7,406.02	2,851.10	29.01			1,219.00	34.20	
Oklahoma.....	15,000.00	8,269.93	1,901.49	82.97	165.34	18.96	1,044.84	625.51	58.65
Oregon.....	15,000.00	12,145.90	982.21	9.83	75.22	96.77	733.14	287.86	
Pennsylvania.....	15,000.00	11,641.37	824.54	10.28	313.73	54.19	713.12	140.02	303.71
Rhode Island.....	15,000.00	7,517.30	3,521.41	54.08	58.23	404.94	344.75	325.18	1.00

Including balances as follows: Arizona, \$4.39; Delaware, \$975; Maryland, \$527.51; Missouri, \$0.10; New York (State), \$134.96.

Expenditures from United States appropriation received under the act of Mar. 16, 1906 (Adams Act), for the year ended June 30, 1917—Continued.

Station.	Amount of appropriation.	Classified expenditures.							
		Salaries.	Labor.	Postage and stationery.	Freight and express.	Heat, light, and water.	Chemicals and laboratory supplies.	Seeds, plants, and sundry supplies.	Fertilizers.
South Carolina.....	\$15,000.00	\$8,769.63	\$3,498.56	\$142.72	\$64.77	\$166.89	\$569.51	\$220.74	\$230.30
South Dakota.....	15,000.00	10,178.35	2,379.70	.....	181.21	71.93	653.30	579.07	.....
Tennessee.....	15,000.00	11,725.84	1,501.45	5.95	58.46	75.67	461.52	77.86	.....
Texas.....	15,000.00	10,075.35	1,866.12	31.21	161.00	314.10	779.98	239.98	2.10
Utah.....	15,000.00	9,136.41	4,275.21	22.52	12.37	200.11	478.23	94.14	.....
Vermont.....	15,000.00	8,154.11	3,362.55	64.00	26.66	64.12	384.17	454.43	5.30
Virginia.....	15,000.00	8,894.90	2,490.19	3.72	57.26	.....	433.77	194.71	370.23
Washington.....	15,000.00	9,633.10	2,001.65	3.93	1,138.86	6.25	78.23	81.48	.....
West Virginia.....	15,000.00	11,258.83	1,400.67	20.11	2.02	9.57	387.30	318.79	203.04
Wisconsin.....	15,000.00	8,910.02	2,025.53	15.89	17.17	152.09	325.91	431.92	.....
Wyoming.....	15,000.00	9,083.05	566.05	10.86	210.30	.....	753.27	73.86	.....
Total.....	720,000.00	494,086.73	81,416.34	2,024.07	5,188.33	5,566.72	25,104.15	11,583.28	2,224.99

Station.	Classified expenditures.							
	Feeding stuffs.	Library.	Tools, implements, and machinery.	Furniture and fixtures.	Scientific apparatus and specimens.	Live stock.	Traveling expenses.	Contingent expenses.
Alabama.....	\$543.59	\$11.00	\$15.09	\$100.10	\$797.55	\$259.00	\$334.07	.....
Arizona.....	28.63	14.22	1,657.19	133.00	920.52	.....	519.05	.....
Arkansas.....	246.50	32.39	307.71	108.63	171.91	393.45	443.34	330.79
California.....	223.84	32.62	38.83	109.24	480.96	38.75	595.81	148.19
Colorado.....	.....	.....	12.18	6.65	510.10	.....	336.85	24.68
Connecticut (State).....	183.31	.....	53.26	41.34	104.61	.....	99.24	156.89
Connecticut (Storrs).....	1,188.38	.....	61.33	.....	.....	8.00	.....	.....
Delaware.....	.....	5.67	22.50	.....	1,036.45	201.70	88.00	40.00
Florida.....	.....	51.77	149.91	129.38	690.64	260.00	784.19	395.65
Georgia.....	495.86	194.65	127.33	52.63	248.18	505.00	81.70	366.90
Idaho.....	78.69	.....	129.82	77.67	1,162.37	.....	375.41	71.95
Illinois.....	690.58	.....	333.73	334.45	3.55	41.65	16.95	119.53
Indiana.....	.....	26.65	101.30	.....	380.51	747.00	451.32	.....
Iowa.....	1,282.50	.....	35.95	.....	413.37	.....	244.74	175.25

Kansas.....	2,773.85	174.10	50.00	477.64	77.30	52.48
Kentucky.....	251.09	178.44	1.00	87.80	71.30	10.25
Louisiana.....	632.90	65.50	542.45	43.00	140.75	747.29
Maine.....	1,496.77	72.08	132.81	2.00	440.65	540.54
Maryland.....		91.61	112.33	80.00	12.62	110.43
Massachusetts.....						
Michigan.....	537.25	15.33	1,143.76	193.99	69.36	116.08
Minnesota.....						
Mississippi.....	1,677.20	2.00		56.50		
Missouri.....	2,530.51	209.05	659.30	485.00	214.57	127.45
Montana.....		93.41	5.39	175.00	2.00	
Nebraska.....		46.85	369.72	580.85		
Nevada.....	51.00	18.70	1,134.10		139.67	18.33
Nevada.....	1,045.42	21.65	1,256.62	1,049.88	186.62	18.00
New Hampshire.....	726.04	5.31	224.70		137.53	472.50
New Jersey.....	360.00		142.51			388.34
New Mexico.....	513.83	10.00	295.54	510.00	32.80	338.40
New York (State).....		381.61				80.16
New York (Cornell).....		288.70	25.44			
North Carolina.....	204.88		285.50	108.05	432.58	43.50
North Dakota.....	966.78	63.49	218.65	1,462.21	120.39	
Ohio.....	754.29	119.25	1,425.66	848.00	201.97	43.00
Oklahoma.....	220.82	207.15	650.66	463.25	108.44	418.25
Oregon.....	54.93	1.50	23.08		44.65	
Pennsylvania.....		13.59	362.96			15.07
Rhode Island.....	1,638.72	28.24	907.69	159.86	62.69	201.71
South Carolina.....		321.96	312.47		9.71	
South Dakota.....		76.60	542.17			158.15
Tennessee.....	310.04	48.00	275.21		45.00	4.50
Texas.....	37.91	87.02	522.13		180.50	42.19
Utah.....	75.05	15.30	200.54	55.00	189.70	264.69
Vermont.....	65.35	45.97	199.43	33.96	268.93	27.34
Virginia.....	1,886.60	20.62	213.37	1,008.25	247.08	256.91
Washington.....	1,256.36	35.60	213.67	450.00	226.68	187.95
West Virginia.....	1,512.49	298.06	10.50	54.95	319.48	45.94
Wisconsin.....	52.05	37.85	425.81		756.00	
Wyoming.....	2,811.41	153.35	130.98	125.90	5.54	
Wyoming.....	1,365.48	75.66	1,607.99	243.50	264.36	461.00
Total.....	29,572.86	1,524.05	22,321.70	10,371.29	10,414.97	7,036.44
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Disbursements from the United States Treasury to the States and Territories for agricultural experiment stations under the acts of Congress approved Mar. 2, 1887, and Mar. 16, 1906.

State or Territory.	Hatch Act.		Adams Act	
	1888-1916	1917	1906-1916 -	1917
Alabama.....	\$434,199.34	\$14,757.08	\$131,619.89	\$15,000.00
Arizona.....	399,803.55	14,999.95	135,000.00	14,995.61
Arkansas.....	433,139.12	15,000.00	134,900.00	15,000.00
California.....	435,000.00	15,000.00	134,926.84	15,000.00
Colorado.....	434,718.82	15,000.00	133,638.93	15,000.00
Connecticut.....	435,000.00	15,000.00	135,000.00	15,000.00
Dakota Territory.....	56,250.00			
Delaware.....	434,382.87	14,000.00	131,450.12	14,025.00
Florida.....	434,966.06	15,000.00	134,996.06	15,000.00
Georgia.....	434,981.55	15,000.00	131,360.67	15,000.00
Idaho.....	359,824.13	15,000.00	130,842.22	15,000.00
Illinois.....	434,564.95	15,000.00	134,851.62	15,000.00
Indiana.....	434,901.19	15,000.00	130,000.00	15,000.00
Iowa.....	435,000.00	15,000.00	135,000.00	15,000.00
Kansas.....	434,995.00	15,000.00	135,000.00	15,000.00
Kentucky.....	434,996.57	15,000.00	135,000.00	15,000.00
Louisiana.....	435,000.00	15,000.00	135,000.00	15,000.00
Maine.....	434,999.62	15,000.00	135,000.00	15,000.00
Maryland.....	434,967.40	15,000.00	134,763.99	14,472.49
Massachusetts.....	434,617.70	15,000.00	135,000.00	15,000.00
Michigan.....	434,676.10	15,000.00	131,341.20	15,000.00
Minnesota.....	435,000.00	15,000.00	134,345.74	15,000.00
Mississippi.....	435,000.00	15,000.00	135,000.00	15,000.00
Missouri.....	430,097.24	15,000.00	135,000.00	14,999.90
Montana.....	345,000.00	15,000.00	132,417.04	15,000.00
Nebraska.....	434,932.16	15,000.00	135,000.00	15,000.00
Nevada.....	434,214.32	15,000.00	133,180.28	15,000.00
New Hampshire.....	435,000.00	15,000.00	135,000.00	15,000.00
New Jersey.....	434,949.97	15,000.00	134,558.78	15,000.00
New Mexico.....	399,509.05	15,000.00	135,000.00	15,000.00
New York.....	434,859.82	14,986.97	134,880.77	14,865.04
North Carolina.....	435,000.00	15,000.00	135,000.00	15,000.00
North Dakota.....	376,778.34	15,000.00	135,000.00	15,000.00
Ohio.....	435,000.00	15,000.00	133,514.02	15,000.00
Oklahoma.....	359,568.96	15,000.00	116,360.56	15,000.00
Oregon.....	420,156.64	15,000.00	130,000.00	15,000.00
Pennsylvania.....	434,967.43	15,000.00	134,995.41	15,000.00
Rhode Island.....	435,000.00	15,000.00	132,464.20	15,000.00
South Carolina.....	434,542.15	15,000.00	133,460.12	15,000.00
South Dakota.....	378,250.00	15,000.00	130,000.00	15,000.00
Tennessee.....	435,000.00	15,000.00	135,000.00	15,000.00
Texas.....	435,000.00	15,000.00	132,592.26	15,000.00
Utah.....	300,000.00	15,000.00	134,821.94	15,000.00
Vermont.....	435,000.00	15,000.00	135,000.00	15,000.00
Virginia.....	432,824.12	15,000.00	134,949.01	15,000.00
Washington.....	372,102.65	15,000.00	131,080.11	15,000.00
West Virginia.....	434,968.71	15,000.00	132,859.12	15,000.00
Wisconsin.....	435,000.00	15,000.00	135,000.00	15,000.00
Wyoming.....	420,000.00	15,000.00	135,000.00	15,000.00
Total.....	10,268,700.13	718,744.00	6,406,170.90	718,358.64

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NOTE.—The abbreviations "Ala. College," "Conn. State," "Mass.," "P. R.," etc., after entries refer to the work of the respective experiment stations, and the words "bulletin," "circular," "memoir," etc., before such abbreviations refer to publications of the respective experiment stations mentioned by title in the text.

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U. S. DEPARTMENT OF AGRICULTURE

COOPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME
ECONOMICS, 1917

PART II OF REPORT ON EXPERIMENT STATIONS
AND EXTENSION WORK IN THE UNITED STATES

1917



WASHINGTON
GOVERNMENT PRINTING OFFICE
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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
STATES RELATIONS SERVICE,
Washington, D. C., September 9, 1918.

SIR: I have the honor to transmit herewith a report on cooperative extension work in agriculture and home economics in the United States for 1917, and on the work of the Department of Agriculture in relation thereto. This report has been prepared in accordance with the following provision of the act of Congress of March 4, 1915, entitled "An act making appropriations for the Department of Agriculture for the fiscal year ending June thirtieth, nineteen hundred and sixteen":

That hereafter there be prepared by the Department of Agriculture an annual report on the work and expenditures of the agricultural experiment stations established under the act of Congress of March second, eighteen hundred and eighty-seven (Twenty-fourth Statutes at Large, page four hundred and forty), on the work and expenditures of the Department of Agriculture in connection therewith, and on the cooperative agricultural extension work and expenditures of the Department of Agriculture and of agricultural colleges under the act of May eighth, nineteen hundred and fourteen, entitled "An act to provide for cooperative agricultural extension work between the agricultural colleges in the several States receiving the benefits of an act of Congress approved July second, eighteen hundred and sixty-two, and of acts supplementary thereto, and the United States Department of Agriculture"; and that there be printed annually eight thousand copies of said report, of which one thousand copies shall be for the use of the Senate, two thousand copies for the use of the House of Representatives, and five thousand copies for the use of the Department of Agriculture (38 Stat. L., p. 1110).

This report embodies all the information heretofore submitted in compliance with the provisions of 38 Stat. L., p. 374, sec. 7.

Very respectfully,

A. C. TRUE, *Director.*

Hon. D. F. HOUSTON,
Secretary of Agriculture.



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REPORT 'ON EXTENSION WORK, 1917.

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- OHIO.—F. L. Allen, supervisor of institutes and schools, Ohio State University, Columbus.
- OKLAHOMA.—J. A. Wilson, director of extension, college of agriculture, Stillwater.
- OREGON.—R. D. Hetzel, director of extension, college of agriculture, Corvallis.
- SOUTH CAROLINA.—W. W. Long, director of extension, Clemson College.
- SOUTH DAKOTA.—H. H. Stener, superintendent of short courses, college of agriculture (P. O. Highmore).
- TENNESSEE.—C. A. Keffer, director of extension, college of agriculture, Knoxville.
- UTAH.—J. T. Caine, III, director of extension, college of agriculture, Logan.
- WASHINGTON.—W. S. Thornber, director of extension, college of agriculture, Pullman.
- WEST VIRGINIA.—C. R. Titlow, director of extension, college of agriculture, Morgantown.
- WISCONSIN.—E. L. Luther, superintendent of farmers' institutes, college of agriculture, Madison.
- WYOMING.—H. G. Knight, director of agricultural experiment station, Laramie.

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COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS, 1917.

INTRODUCTION.

This is the third report on the receipts, expenditures, and results of cooperative agricultural extension work in the 48 States under the provisions of the act of Congress of May 8, 1914 (agricultural extension act), and of similar work conducted in connection therewith under cooperative agreements between the United States Department of Agriculture, the State agricultural colleges, and local organizations. Since July 1, 1915, the business of the Department of Agriculture in relation to the cooperative extension work has been carried on by the States Relations Service through two extension offices, one having charge of the work in 15 Southern States; the other in the 33 Northern and Western States. In each State the agricultural college has carried on this work through an extension division, at the head of which is an officer, ordinarily called an extension director, who is administratively responsible for the work throughout the State and in this capacity acts as a joint representative of the department and the college.

The reduced yield of important staple crops in the United States in 1916 due to adverse climatic and other conditions, combined with the greatly increased need of European peoples for these products, made it necessary for the department and the State agricultural institutions to modify and intensify their plans and activities relating to the agriculture of this country in 1917. This necessity was vastly augmented when the United States entered the war, and it became essential to organize its agricultural forces on a war basis and to instruct the people in both city and country how best to utilize and conserve a limited food supply. To a remarkable extent the people throughout the country turned to the Department of Agriculture and the State agricultural colleges for advice, assistance, and leadership in these matters. The fact was widely recognized that in the cooperative extension system, with its combination of Federal and State administrative officers and subject-matter specialists, with county agents, farm bureaus, and other local organizations, a very effective means was provided for nation-wide dissemination of the

needed facts, and for practical demonstrations of the measures required to increase agricultural production along the best lines and to secure the most economical utilization of the products of the farms in the homes of the people. Congress responded to the widespread demand for the immediate expansion of the cooperative extension forces by taking up legislation to this end, but pending its discussion and passage the department and the States speeded up their work along these lines with such forces and funds as they were able to obtain and utilize. Thus the work of these agencies was profoundly affected and increased before the end of the fiscal year and the foundation was laid for a much greater service now that larger resources have been put at their command. Much of the increased acreage and yield of important staple crops, the multitude of home gardens, the canning or other preserving of perishable products, and the modification of southern agricultural practice by increasing the production of foodstuffs without injury to cotton growing has been due to the efforts of these agricultural agencies prior to the end of the last fiscal year.

The number of counties having the services of a county agent at the beginning of the year was 1,278, and at the end of the year, 1,434. The number of counties having the services of a home-demonstration agent increased from 430 to 537. (Pl. I.) The total number of persons employed in the cooperative agricultural extension work increased from 3,020 to 4,100. The increase in the number of women employed was from 754 to 1,117 and of men from 2,266 to 2,983; 3,025 were giving their entire time to extension work, 336 more than half time, and 739 less than half time. Of those giving part time to extension work, 238 were connected with the experiment stations and 291 were connected with the college teaching staffs.

For the fiscal year 1917, under the provisions of the Smith-Lever Act, the sum of \$1,580,000 was appropriated from the Federal Treasury and \$1,100,000 from sources within the States, making a total of \$2,680,000. Of this amount \$995,000 was used for county agents, \$390,000 for the demonstrations and other work in home economics, \$155,000 for the boys' clubs, and \$105,000 for extension schools. The salaries and expenses of the supervising officials and their administrative assistants amounted to \$350,000, and \$80,000 was spent for the printing and distribution of publications.

The total amount of money expended for the cooperative agricultural extension work in 1917 was about \$6,100,000, as compared with \$4,800,000 in 1916. This is an increase of \$1,200,000, or about 25 per cent. In 1917 these funds were derived from the following sources: Federal and State Smith-Lever, \$2,680,000; appropriations to the States Relations Service of the Department of Agriculture for farmers' cooperative demonstration work, \$960,000; appropriations

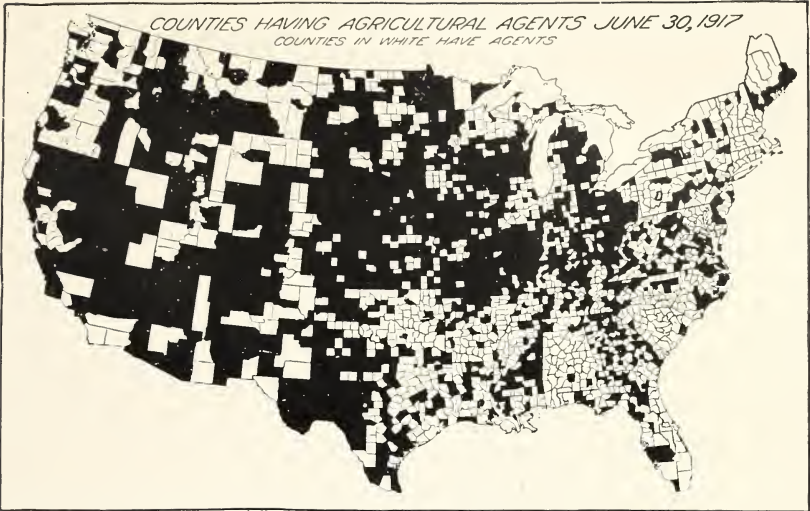


FIG. 1.—COUNTIES HAVING AGRICULTURAL AGENTS.



FIG. 2.—COUNTIES HAVING HOME DEMONSTRATION AGENTS.

COUNTY AND HOME DEMONSTRATION AGENTS, JUNE 30, 1917.

to other bureaus and offices of the department, \$185,000; State funds appropriated specifically for extension work (in excess of Smith-Lever funds), \$635,000; appropriated by county authorities, \$1,260,000; fund under direct control of the colleges, \$200,000; and \$245,000 from various sources, such as farmers' organizations, chambers of commerce, individuals, etc.

Of this total amount from all sources, about \$3,060,000, or one-half, was used for the work of county agents, and \$740,000 for the home-demonstration agents and home-economics specialists, including the girls' club work.

Among other important items were \$320,000 for the boys' clubs, \$170,000 for extension schools, \$510,000 for supervision and administration, \$135,000 for publications, \$145,000 for animal husbandry, \$210,000 for dairying, \$100,000 for farm management, and \$100,000 for special work on farm crops. The remainder was chiefly spent on the work of specialists in animal diseases, horticulture, plant diseases, entomology, agricultural engineering, etc., and on correspondence courses, farmers' institutes, educational exhibits at fairs, and the promotion of the teaching of agriculture in rural schools.

In 1917 the farmers' institutes in 17 States were managed by the State departments of agriculture. In the other States they were under the control of the agricultural colleges and formed a part of the general system of agricultural-extension work, often being closely connected with the more systematic scheme of popular instruction in agriculture and home economics embodied in the so-called extension schools. The number of meetings of farming people held in connection with the work of the county and club agents and extension specialists has greatly increased with the development of the co-operative extension system. These meetings, however, have very largely had demonstrations in the field and elsewhere as their central interest and thus have become more practical and definitely educational.

EXTENSION WORK IN THE SOUTH.

ORGANIZATION AND ADMINISTRATION.

Extension work in the South was continued along the same general lines in 1916-17 as in previous years. No vital changes of policy were necessary in any of the States. A few new projects were added, but the increased funds were used principally in building up lines of work already established.

The following changes and additions in the administrative, supervisory, and other workers have taken place during the year: In Florida, Kentucky, and Oklahoma assistant directors were added. In Arkansas Director J. H. Miller resigned and was succeeded by W. C. Lassetter as acting director. At the end of the fiscal year Mr. Lassetter was made director. Mason Snowden, State agent in Louisiana, died in March, 1917, and was succeeded by W. R. Perkins as State agent. July 1, 1917, W. R. Dodson resigned as director of extension in Louisiana and W. R. Perkins became director and State agent. Miss Alice Keeler, State agent in home economics and girls' work, resigned and was succeeded by Miss Alice Hickman. In Maryland G. H. Alford resigned as State agent and was succeeded by Frank B. Bomberger as assistant director, the title of State agent being abolished. In Tennessee, H. D. Tate, assistant director, resigned July 1, 1917, and was succeeded by W. A. Schoenfeld. In Texas, Director Clarence Ousley was temporarily called to Washington as Assistant Secretary of Agriculture, and T. O. Walton was made acting director. Miss Berniece Carter, the State agent in home demonstration and girls' work, also resigned, and was succeeded by Miss Laura F. Neale. In Virginia, President J. D. Eggleston, who had been acting director of extension, resigned and was succeeded by Jesse M. Jones as director on July 1, 1917. In Alabama, Miss Madge Reese, the State agent in home economics, resigned and was succeeded by Miss Mary Feminear. There were changes in the district, county agent, and specialist forces in all the States.

At the close of the fiscal year, June 30, 1917, the total number of field agents, exclusive of administrative officers and specialists, was 964 men agents and 553 women agents. The classified increase for the year was as follows: Seven men and 7 women district agents, 158

men county agents, 38 assistant county agents, 104 women county agents, 13 negro local agents, and 39 specialists.

PUBLICATIONS.

During the year 407 publications were issued, containing 3,946 pages, aggregating 5,372,650 copies. The distribution of extension literature for demonstrators, cooperators, and boys' club members is made chiefly through county agents. It is sent to the agents in bulk and either given out by hand or mailed to the people on their lists. The directors report an aggregate mailing list of about 200,000 names, but these lists are of a more or less miscellaneous nature, composed of business men, editors, and other interested persons. The total cost of publications in the 15 Southern States was \$43,338.50. Only \$39,978.50 of this was from Smith-Lever funds, which is less than $3\frac{1}{2}$ per cent of the total Smith-Lever allotment.

All publications are prepared by members of the extension force or members of the State agricultural college or experiment station force. The subject matter is approved by heads of divisions under which they come and they are written in popular and practical style, suitable for general distribution among farmers.

FINANCES.

All funds for extension work in the South were spent in accordance with acts of Congress making the appropriations and the laws of the States, where State funds were involved. The following funds were used in 1916-17:

Smith-Lever (Federal)-----	\$650, 168. 07
Smith-Lever (State)-----	500, 168. 07
United States Department of Agriculture (States Relations) -----	588, 932. 73
United States Department of Agriculture (other bu- reaus) -----	116, 387. 36
State appropriations-----	117, 797. 88
College appropriations-----	14, 839. 95
County appropriations-----	656, 714. 57
Other appropriations-----	85, 174. 09
Total-----	2, 730, 182. 72

Smith-Lever funds were expended in carrying out the following projects: Administration; publications; county agents—mill village and negro men; home economics—negro women and girls, poultry clubs, home demonstration and mill village; extension schools—movable schools and field meetings; boys' club work—pig clubs, negro boys' clubs, corn production and improvement; animal husbandry—live stock; poultry; dairying—cheese making and creamery; animal diseases—veterinary and hog cholera; agronomy; horticulture—fruit

and truck work; plant pathology—control and distribution of hybrid grains and other crops; entomology—beekeeping; agricultural engineering—drainage, farm, and home conveniences, and rural sanitation; farm management; rural organization—community programs and community organization; marketing—marketing and curing of meat, cotton grading and marketing, growing and shipping truck, and market clubs; exhibits and fairs; specialists, and traveling expenses of experts.

No one State had all these projects. Every State had administration, county agents, boys' clubs, home demonstration and girls' clubs, and publications. Several projects listed are practically the same work but have different names in different States. The salary of county agents in all the States is paid partly from local funds and partly from the State divisions of extension and United States Department of Agriculture funds.

A detailed financial statement of the expenditures of all the extension funds from the States has been submitted and approved.

COUNTY AGENTS.

The whole system of extension work is centered about the county-agent project. More than half of all the extension funds from all sources is spent on this branch of the service. During the year 860 county agents, 28 assistant county agents, 31 county agents (boys' clubs), and 66 negro local agents were employed. The aim is to have a man and a woman county agent in all agricultural counties as soon as funds are available.

Congress passed the food-production act, to stimulate crop production, early in the new year beginning July 1, 1917, and this is temporarily providing for carrying out the idea of supplying agents for all counties. The agent is now almost generally recognized as the agricultural leader in his county. It should be understood that all results accomplished in extension work are not credited entirely to the agent's individual efforts. He is the medium through which all agricultural workers in the county, whether members of the extension force or others, must work. The scope of the work and the responsibilities of the agent have been so increased that he is forced to utilize the help of specialists, members of the college force, and the community leaders, to meet all the calls made upon his time. All agents are required to submit definite plans of work at the beginning of the year, outlining the main features that it is proposed to push. A few fundamentals which all agents are required to know and observe are that the agent's services belong to all the people in the county; that a limited number of concrete demonstrations with staple crops must be established in all parts of the county; that individual work must be limited; that leading problems rather than

details must be kept in mind; and that community or other agricultural organizations must be utilized to the fullest extent. Of course, attention must be given to all agricultural problems; but the principal part of the work must be confined to definite problems.

When the United States entered the war in April, 1917, all branches of the cooperative extension work of the State agricultural colleges and the United States Department of Agriculture in the Southern States were materially affected. Plans for the year were definitely changed to meet emergency conditions. It was decided in conference of all the agricultural workers of the country that the most important problem of the American farmer was to increase food production. All other lines of the work were made secondary to this great problem. Consequently, the larger portion of the time of all agents and other extension workers was given to food production and conservation work.

Although the emergency funds appropriated by Congress did not become available until August, 1917, the plans for carrying on extension work were definitely rearranged to meet the emergency needs of the country. In most of the States new agents were employed before the close of the fiscal year with the regular department, State, and county funds, anticipating the subsequent passage of the food-production act. When the law became operative, additional agents were appointed; but it was well into the fall before the full effect of the food-production act could be felt. Nevertheless, it is only just to report as a part of the accomplishments of the cooperative extension work in the 15 Southern States the entire work for the year 1917, because this work was very largely accomplished by those who were appointed and actively in the service before June 30.

Organization.—Special attention should be called to the fact that activity in organization work increased in 1917. In practically every county in the South where there was a county agent in 1917, he received his salary partly from the United States Department of Agriculture, partly from the Smith-Lever funds in the hands of the State agricultural college, and partly from the county. The total county appropriations for that year, over and above all offsets to the Smith-Lever fund in the Southern States, amounted to \$656,714.57. These funds are generally derived from direct appropriations from the county fiscal authorities, either the county court, county board of supervisors, county board of education, or other authority receiving its funds from public taxes. Almost all funds for the payment of salaries of county agents, therefore, come from public sources.

Types of supporting organizations by counties vary in the different Southern States, according to local conditions, but are developing very strongly. The following figures for the three years, 1915, 1916,

and 1917, taken from the agents' reports, show the great increase of local farmers' or community clubs to support the county agent in his work. Farmers' or community clubs organized: 1915, 1,712; 1916, 2,508; 1917, 3,507. Membership thereof: 1915, 44,458; 1916, 78,660; 1917, 112,316.

Development in community organization has been very marked in most of the States. In some counties where the agents' work had been well established, organization was not so necessary, because in such counties the county agents are known by all the people and their work is recognized as a public activity. The department, however, has constantly urged the advisability of perfecting strong organizations in every county. There is no ironclad rule for perfecting organizations. In some States a committee of farmers, representing all sections of the county, is selected to form an advisory council with the county agent. With this as a basis, local or community organizations are formed and these federated together through this committee into a county organization. In some States, however, the county central organization was deferred until the community organizations could be perfected.

The emergency war work has brought about a greater interest in organization. In many States there is a tendency to unify the organization system, so that the National, State, and county councils of defense and the United States food administrators may co-operate, and the whole serves as the supporting organization of the county agent. Hence the organization work in the South was, at the termination of the fiscal year ending June 30, 1917, in a condition of rapid transformation, the results of which can not be fully reported until another year has passed.

Number of farmers reached.—The total number of farmers and farm women reached in the work is a matter partially of accurate record and partially an estimate. Every county agent in the South conducts a large number of demonstrations for the purpose of illustrating the best agricultural practices. This regular and definite work went forward in the year 1917 as in other years. The same is true of the home-demonstration agents and boys' club agents. They conducted their work along the regular lines of enlisting persons to demonstrate on farms and in homes.

Under pressure of the war, however, in 1917 a large amount of emergency work was done, and there was a great increase in the number of farmers, farm women, and boys and girls reached and instructed in problems of greater food production, canning, preserving, and otherwise conserving food for future use. Agents of all kinds gave advice and instructions to everyone with whom they came in contact. The organizations working with them greatly increased the number of persons reached.

Reports from county agents show that 303,723 farms were reached with definite demonstrations in the growing of crops, raising and feeding of live stock, marketing problems, etc. The number of acres covered by the crop demonstrations alone in 1917 was 2,857,485. In addition to these, a conservative estimate of the number of farms directly reached by the county agents in 1917 is 1,650,000. This estimate is in all probability much below the actual facts. This is about 60 per cent of all farms in the South. The direct and indirect influence of the county-agents' work and the proportion of the farmers reached during the year was much greater.

In the boys' club work, conducted by the club specialist and the county agents, assisted by county superintendents, school-teachers, and other group leaders, a great deal of extra work was done. As in the work with farmers and with farm women and girls, the boys' work during 1917 may be roughly divided into two kinds: (1) enrollment of boys in regular clubs, and (2) enrollment for emergency work, larger in the number of persons reached but possibly less strict in requirements. The total enrollment of boys in all types of clubs in the South in the past year in the regular work was 115,745, while in emergency work between 300,000 and 400,000 additional boys received the personal attention of the county agents and others.

In the regular home-demonstration work 82,227 women did regular work in their homes and their community clubs, and 3,812 community clubs were organized for women for purposes of instruction. In the girls' work 73,306 were enrolled in regular organized clubs. These people, like the men demonstrators, gave accurate reports of results. For example, the girls put up 12,844,513 cans of fruits and vegetables, while the women put up 34,993,677 cans. These women and girls also used the new home drying process, taught for the first time last year, and thus saved 5,511,881 pounds of vegetables and fruits. They pickled or brined 1,178,683 gallons of vegetables.

In addition to this regular work the agents secured an emergency enrollment of about 2,600,000 women and girls, who undertook to raise gardens, and to can and preserve the products. It was impossible to get full reports from this emergency enrollment, but a very conservative estimate of the results obtained by them would warrant the statement that approximately 200,000,000 cans of fruits and vegetables were conserved through the activities of the home-demonstration agents in the year 1917.

In the spring of 1917 a very noteworthy piece of work was performed by the Office of Extension Work in the South, in cooperation with the extension service in each of the 15 Southern States. It was discovered that the supply of tin cans, owing to war conditions, was exceedingly limited. The War Industries Board, the Food Administration, priority boards, etc., had so drawn upon the steel pro-

duction of the country, and the ocean traffic had so limited the supply of tin that there was grave danger that home canners would not be able to obtain tin cans. In cooperation with the Bureau of Chemistry, the Council of National Defense, War Industries Board, and other public offices in Washington, an arrangement was made for the distribution of tin cans by having each home-demonstration agent arrange for pooling of orders in her county through some business man or public-spirited organization. These local parties gave the orders, which were approved by the home-demonstration agent, by the State director of extension, and by the Office of Extension Work in the South, with the definite understanding that cans would be distributed to users at cost, plus freight and handling charges. This action not only greatly steadied the price of tin cans in the field, but assisted in the distribution of approximately 10,000,000 tin cans to farm women and girls for the preservation of food for future use.

Food-production campaigns.—The food-production campaign for the year 1917 was planned to stimulate food production to the extent of supplying the South with food and feed from its own soil. The "safe-farming" program advocated by the department was a simple and direct program, involving the production on every farm of the food for the family and the feed for the live stock, as a means of economic safety. An increase of corn, hay, peanuts, soy beans, velvet beans, and home gardens, including both Irish and sweet potatoes, and sorghum or cane for sirup, for human food and for feed for the live stock, was asked. The program also emphasized the importance of each farm being, as nearly as possible, self-sustaining. It recommended the supplying of milk, eggs, and meat for the family on every farm and an increased production of all of these food products, so that the excess might supply cities and towns. After the food supply had been amply cared for, it recommended the production of cotton as the main cash crop in all cotton territory.

In 1917 there was an increase in the production of all food crops in the South, except rice and hay. As to rice, there was a slight decrease over 1916, due principally to protracted drought and salt water. The corn crop increased from 803,189,000 bushels to 930,868,000 bushels, which is the largest corn production in the South, except that in 1915.

The wheat crop increased but slightly, owing to the bad winter of 1916-17. The record shows an increase from 106,626,000 bushels to 117,662,000 bushels. The oat crop, on account of heavy winter-killing shows a very slight increase. In 1916, it was 139,179,000 bushels; in 1917, 139,503,000 bushels. The hay crop did not increase, owing partly to the high price of winter legume seed, partly to seasonable conditions, and partly to the great increase in the velvet-bean crop, which is not scheduled by the Bureau of Crop Estimates as hay.

The hay figure for 1916 was 10,879,000 tons; for 1917, 10,319,000. Irish potatoes increased from 48,691,000 bushels to 67,982,000 bushels. Sweet potatoes increased from 64,720,000 bushels to 79,630,000 bushels. The acreage in velvet beans increased 179 per cent; peanuts increased 94 per cent; and the garden, fruit, and other crops of similar nature increased by several hundred per cent.

The following table shows the progress of the 11 cotton States of the South in the production of food and feed crops, as compared with cotton. The percentage of increase in the production of corn, wheat, oats, hay, potatoes, and sweet potatoes will be seen to be great during the nine years shown in this table, though the production of cotton has not materially increased.

Total acreage and production of various crops, 1909 to 1917, in 11 Southern States.

(Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas.)

[000 omitted.]

Crop.	1909	1910	1911	1912	1913	1914	1915	1916	1917	Per cent of increase over 1909.
Cotton:										
Acreage.....	30,834	32,261	35,861	34,124	36,016	36,575	31,228	34,733	32,273	4.68
Production (bales).....	9,948	11,524	15,549	13,612	14,034	15,964	11,992	11,303	10,786	8.42
Corn:										
Acreage.....	30,808	34,119	35,233	35,904	35,176	34,074	36,860	35,144	39,635	28.81
Production (bushels).....	461,543	664,752	539,136	685,333	658,252	610,851	786,045	600,294	682,643	47.90
Wheat:										
Acreage.....	2,728	3,914	3,531	3,920	4,188	5,315	7,635	6,845	6,641	142
Production (bushels).....	28,622	55,120	34,619	46,829	51,009	85,188	93,276	68,854	74,857	162
Oats:										
Acreage.....	2,979	3,378	3,630	3,576	4,140	4,355	6,443	6,140	5,584	87.4
Production (bushels).....	51,847	90,577	65,596	90,659	97,237	102,685	166,314	122,445	120,613	133
Hay:										
Acreage.....	2,730	2,776	2,599	3,262	3,487	3,478	3,971	4,560	5,601	105
Production (tons).....	3,108	3,428	2,611	4,295	4,214	4,577	6,476	6,154	6,510	109
Potatoes:										
Acreage.....	241	246	253	252	259	260	276	275	353	46.5
Production (bushels).....	16,693	17,593	13,765	19,084	17,798	16,297	21,621	19,366	27,987	67.7
Sweet potatoes:										
Acreage.....	520	520	492	473	515	495	606	653	834	60
Production (bushels).....	43,597	46,502	42,615	43,832	47,055	45,481	61,826	57,336	72,870	67

¹ 500 pounds, excluding linters.

Wheat and rye campaigns.—In the fall of 1917 a wheat and rye campaign was conducted in the South, as in all other sections, resulting in a general increase in the seeding of these crops, ranging from 1 per cent to 100 per cent. Kentucky, Tennessee, and North Carolina, among the heavy winter-wheat sections, showed excellent increases, ranging from 8 to 12 per cent on large acreage. Rye campaigns showed equally good results.

Hog production campaign.—A campaign to increase the production of hogs was conducted in the Southern States with gratifying results. On account of the severe drought and the lack of feed in Texas and Oklahoma, there was a decrease in actual production in these States. The other States showed a very remarkable increase: Tennessee, with an increase of her brood sows of 18 per cent; Georgia, with an increase of 7 per cent; and West Virginia, with 8 per cent, are noteworthy. Alabama increased 12 per cent, Arkansas 15 per cent, Mississippi 12 per cent, Kentucky 5 per cent, South Carolina 6 per cent, and Maryland 8 per cent.

Texas drought situation.—Owing to severe drought in western Texas, extending over a period of practically two years, a large section of that State was in dire distress in the summer and fall of 1917. County agents were used by the department in emergency plans to assist the people of that section. In cooperation with the Bureau of Animal Industry a movement was begun in the summer of 1917 to sell good breeding stock from western Texas and transport it to States and localities where there was plenty of pasturage. In this way practically 300,000 head of cattle were taken from Texas and sold to farmers in Louisiana, Arkansas, Oklahoma, Mississippi, Alabama, Georgia, and Florida. Later in the fall of 1917 conditions regarding feed for remaining stock on Texas ranches became acute, and the county agents assisted the Bureau of Markets in a plan for locating supplies of feed on the one hand, and procuring the purchase of the same in the drought-stricken areas on the other, the result of which was the steadying of the market and the saving of many cattle.

In addition to the many other lines of work conducted by the county agents and home-demonstration agents in 1917, they assisted other branches of the Government, such as the United States Food Administration, the Treasury Department, the Department of War, Department of the Navy, Department of Justice, Department of Labor: and they in turn were materially assisted by the Post-Office Department, the Department of Labor, and the Food Administration.

The extraordinary lines of work in which they assisted, beyond those already mentioned, were such things as food surveys, seed surveys, seed distribution, campaigns for the destruction of insect pests, the eradication of live-stock diseases, insect pest surveys, live-stock disease surveys, obtaining of credit for farmers, selling of Liberty bonds, the marketing of farm products, preferential or priority shipments by rail of farm products and of all farm supplies, such as tin cans, farm machinery, fertilizers, lime, seeds, etc. They also assisted in much patriotic work, and in the dissemination of material given out by the War Department, the Council of National Defense, and the Committee on Public Information regarding the

war, and other matters affecting the national policy under war conditions.

Summary of leading results of county-agent work.—The following summarizes some of the leading features as direct results of the agents' work: There were 41,379 cotton demonstrations, containing 501,729 acres, with an average yield of 1,032 pounds of seed cotton per acre; 75,817 corn demonstrations, with 799,476 acres, giving an average yield of 38.24 bushels; 44,908 small-grain demonstrations, with a total of 387,497 acres; 6,316 demonstrations in alfalfa; 5,573 in crimson clover; 1,531 in red clover; 3,400 in bur clover and sweet clover, making a total of 15,823 clover demonstrations, with 115,280 acres. There were 41,781 demonstrations with grasses and forage crops, with a total of 252,132 acres. There were 90,150 demonstrations with summer legumes (cowpeas, soy beans, velvet beans, and peanuts) with a total of 876,484 acres; 9,254 potato demonstrations; 5,061 orchard demonstrations, containing 635,864 trees; 37,017 orchards, with 2,980,294 trees, were inspected, sprayed, pruned, and treated for insects and diseases. Improved live stock to the number of 195,231 head were brought in, and 3,297,872 head of live stock were treated for diseases during the year, including 742,939 hogs for cholera; 2,256 dipping vats were built and 5,517 silos; 156,804 farmers were advised in the use of fertilizer; 6,413 houses were built, 8,795 improved, and 3,028 plans furnished; 1,753 home waterworks were installed, and 3,012 lighting systems; 11,233 home grounds were improved and 33,720 houses screened; 1,998 telephones were placed, 12,135 new pastures started, and 20,439 farmers terraced their land, 9,776 removed stumps; 315,654 home gardens were planted; 388,708 farmers saved surplus products for winter use; 103,802 new tools and implements were purchased. The agents visited 885,966 farms, traveled 10,285,121 miles; had 765,207 calls for information at their offices or homes; held 46,172 meetings, with a total attendance of 3,676,590, and held 22,599 field meetings, with an attendance of 203,813. Agents distributed 1,249,852 United States Department of Agriculture bulletins and 964,369 State bulletins; visited 38,855 schools in the interest of club work; assisted at 872 extension meetings or short courses, with an attendance of 136,317. As a result of club work, 5,667 girls and boys attended agricultural colleges or other industrial schools. Farmers' or community clubs to the number of 3,507 were organized, with a membership of 112,316.

NEGRO WORK.

Substantial progress was made in agricultural extension work among negro men and women. This work is now well organized in Mississippi, North Carolina, Georgia, Florida, Alabama, Virginia,

Arkansas, and Louisiana. There are one or more agents in all the other States. The white agents in all the States continued to list negro demonstrators and assist them in many ways.

The extension division of the State agricultural college cooperates with the negro colleges in the conduct of this work. District agents in charge usually have headquarters at these institutions. The negroes receive demonstration work gladly and cooperate splendidly in every way. A fine spirit of loyalty and patriotism has been manifested by the negro population since the beginning of the war. They have contributed liberally to the Liberty Loan, War Savings Stamps, and the Y. M. C. A., and responded to other patriotic appeals. The farming element has done everything possible to assist in the national program for increased food production.

There are now employed 66 negro men agents and 7 women agents. The directors in most of the States plan to increase the work among negroes very materially from emergency funds. The negro boys' and girls' home-makers' club work has grown rapidly. Since the organization of home-economics work for negro women a very marked improvement is noted in the appearance of the home and its surroundings. Gardening, canning, sanitation, and conservation of food work has been well established in many counties.

BOYS' CLUB WORK.

The general plan for conducting agricultural club work had already been made, the boys enlisted, and many crops planted before this country entered the war. The Office of Extension Work in the South sent out an urgent letter to all the State leaders to increase their enrollments to the limit, especially for members who would grow any kind of food crops. This appeal resulted in increasing the regular enrollment from 75,605 in 1916 to 115,746 in 1917.

A large number of boys were enrolled as emergency workers. They were not required to make complete reports like the regular members, but pledged themselves to do something to increase food production. The number thus interested might be conservatively given as 300,000.

The crop production club boys worked with corn, grain, sorghum, potatoes, peanuts, and cotton. The animal production club boys worked with pigs, calves, sheep, and poultry. A beginning was made during the past year in bee clubs. It is estimated that boys in the regular clubs produced food and feed valued at over \$4,000,000. The total produced as a result of club-work influences was, of course, very much more.

How the club work is organized.—Heretofore, in a majority of the States, the county was the unit of organization. The county

agent visited and instructed the boys as individuals. The membership, however, became so large that individual visits by the agent were impossible. The boys were, therefore, organized into community groups for instructional purposes. During the year more than 2,000 of these community clubs were organized.

How club members are instructed.—The club members meet in groups with the agent, generally on a boy's demonstration. Here they report progress of work, receive instruction from the agent regarding culture of crop or care of the pig, calf, etc. Besides the personal instruction given by the agent, the boy is sent circular letters and bulletins from time to time. Several States get out monthly publications containing community programs, timely instructions on demonstrations, etc., which are sent to all members.

Cooperation.—The community club, acting as a unit, can give better cooperation and results in good teamwork. This was demonstrated by many clubs taking an active part in the campaigns for the Red Cross, Y. M. C. A., Liberty bonds, and other patriotic moves.

Effect of club work on boys.—Farm methods and farm practices throughout the territory are being greatly improved by boys' club work. The older members are developing into community leaders, and, when they grow beyond the club age, naturally become enthusiastic advocates of better methods on the farm. The clubs are great feeders for agricultural high schools and colleges. One State reports 218 boys in attendance at such schools as a direct result of the influence of the club work. Short courses for club members have been held in nearly all the States. Those attending are usually the prize winners in their home clubs and get their expenses paid while at the school as a part of the reward.

The following tables show the enrollment of boys in the various clubs, by States, and the results of some of the crop club work:

Number of boys enrolled in various clubs in 1917 in the Southern States.

State	Total.	Corn.	Pota- to.	Cot- ton.	Grain sor- ghum.	Pea- nut.	Cal.	Pig.	Poul- try.	Mis- cella- neous.	Ne- groes.
Alabama.....	10,884	4,660	61	836	.....	51	.....	3,460	.....	1,636	180
Arkansas.....	9,573	2,514	941	553	.....	314	.....	2,781	195	450	1,830
Florida.....	3,079	1,132	5	.....	.....	34	2	652	.....	1,254	.....
Georgia.....	13,367	6,057	34	284	.....	77	1,129	4,250	1,050	324	153
Kentucky.....	3,887	751	201	.....	.....	5	211	1,063	1,414	237	.....
Louisiana.....	10,498	2,400	100	200	.....	.....	153	3,645	1,000	.....	3,000
Maryland.....	1,413	467	350	.....	.....	.....	15	136	117	128	200
Mississippi.....	11,360	5,072	.....	.....	.....	.....	332	4,226	.....	.....	1,730
North Carolina.....	10,090	3,652	343	120	.....	123	.....	1,900	2,500	29	1,423
Oklahoma.....	11,863	3,011	15	1,932	1,326	988	413	1,830	1,446	267	555
South Carolina.....	2,355	1,056	.....	.....	.....	.....	49	1,250	.....	.....	.....
Tennessee.....	3,071	2,930	51	.....	.....	.....	.....	99	.....	.....	.....
Texas.....	12,869	3,613	.....	1,339	800	1,433	569	5,115	.....	.....	.....
Virginia.....	5,462	2,499	178	33	.....	132	65	516	1,350	374	315
West Virginia.....	5,919	580	1,153	.....	.....	.....	.....	906	2,611	642	22
Total.....	115,695	40,394	3,441	5,297	2,126	3,157	2,968	31,875	11,633	4,087	10,667

Some results of club work in 1917 in the Southern States.

State.	Corn.				Cotton.			Potato.			Peanut.		
	Number of members reporting.	Average yield per acre (bushels).	Average cost per bushel.	Number of members making 100 or more bushels per acre.	Number of members reporting.	Average yield per acre (pounds of seed cotton).	Average cost per pound.	Number of members reporting.	Average yield per acre (bushels).	Average cost per bushel.	Number of members reporting.	Average yield per acre (bushels).	Average cost per bushel.
Alabama.....	741	46	\$0.41										
Arkansas.....	555	47	.34	6	79	995		48	107	\$0.47	26	39	\$0.12
Florida.....	413	37	.44	4				2	441	.86	4	51	.39
Georgia.....	1,368	45	.40	14									
Kentucky.....	252	57	.38	4				79	199	.32			
Louisiana.....	1,317	29	.32										
Maryland.....	207	60	.33					148	162	.43			
Mississippi.....	1,038	53	.43	42									
North Carolina.....	650	59	.36	40		913		15	268	.35			
Oklahoma.....	359	33	.49		273	\$71	\$0.026	2	166	.39	129	43	.49
South Carolina.....	501	53	.40										
Tennessee.....	1,384	59	.33					17	168	.49			
Texas.....	218	27	.53		23	829	.03				36	35	.38
Virginia.....	514	54	.39		12	1,032	.033	53	185	.48	55	52	.57
West Virginia.....	268	67	.28					581	176	.36			
Total.....	9,785	47	.38		387	897		945	214	.37	250	43	.49

Pig clubs were organized in every State, and the following table shows some of the results accomplished:

Some results of pig-club work in 1917 in the Southern States.

[Average net profit per member.]

State.	Number of members reporting.	Feeding demonstrations (average net profit per member).	Breeding demonstrations (average net profit per member).	Sow and litter demonstrations (average net profit per member).
Alabama.....	270	\$12.31	\$24.48	
Arkansas.....	451		23.07	\$23.75
Florida.....	225	30.69		
Georgia.....	1,279		20.59	
Kentucky.....	438	4.54	16.16	93.81
Louisiana.....	119	10.62	15.37	
Maryland.....	46			
Mississippi.....	698	4.55	14.72	216.01
North Carolina.....	250	20.64	34.18	37.21
Oklahoma.....	62	22.28		
South Carolina.....	856			
Tennessee.....				
Texas.....	127	17.23	25.83	41.75
Virginia.....	132	21.45	18.91	
West Virginia.....				
Total.....	4,953	12.15	20.41	110.53

Calf clubs were organized in seven States, with a membership of 2,968. The results of those reporting show an average net profit of \$37.76 per head.

Home-makers' clubs for negro boys were organized in six States; total enrollment, 3,439, all of which were in crop clubs. The average

yield of those reporting was 48 bushels of corn per acre at an average cost of 38 cents. The average yield of peanuts was 48 bushels per acre, at a cost of 33 cents.

HOME DEMONSTRATION AND GIRLS' CLUB WORK.

The 1917 report on home demonstration and girls' club work sets a new high record of progress and results in this useful and popular branch of the extension service in every one of the States represented in the extension work in the South. Although the plans and aims of the year had already been mapped out for extraordinary accomplishments, the emergency demands as a result of the Nation's entrance into the war made it necessary to put forth still more strenuous efforts to produce and conserve the maximum amount of foodstuffs. In anticipation of Congress making an emergency appropriation for the stimulation of food production every State put on extra workers before the close of the fiscal year in order to meet the unusual demands for assistance and instruction in canning, drying, preserving, and brining the immense crops of fruits and vegetables then maturing in the gardens and orchards.

At the close of the fiscal year, June 30, 1917, there were employed in home demonstration and girls' club work the following workers: Twenty-nine State and assistant State agents, 17 district agents, 513 county agents, 7 negro local agents, and several home-economics specialists.

The home-demonstration agents during the calendar year 1917 had an enrollment of 61,589 girls as members of their regular canning clubs and 11,717 girls in poultry clubs; 2,995 women were enrolled in special poultry work.

The work is organized mainly on the community basis. In counties which have had home-demonstration agents for any length of time, are community organizations of farm women and girls who meet regularly with the agent to receive instructions and make demonstrations. During the year 3,812 rural women's clubs were in operation, an average of more than five for each county, with an agent. The total enrollment in the clubs was 82,227.

In addition to the regular enrollment indicated above, the emergency enrollment included 1,470,408 women and 980,272 girls, each of whom undertook, under the instruction of the home-demonstration agents, to do some specific work in food production and preservation, such as canning, drying, preserving, or brining.

The canning-club girls are required to cultivate one-tenth of an acre, and from those plats in the 15 Southern States they put up last year 8,882,738 containers, the value of which amounted to \$1,511,048.42. Besides this the girls filled 3,961,775 containers, valued

at \$982,366.26, from the farm and orchard, which gives the total amount put up by the canning-club girls as 12,844,513 containers, valued at \$2,493,414.68.

During 1917 the women filled 34,993,677 containers, valued at \$7,042,137.63. This, together with the girls' work, brings the total amount canned by the women and girls under the instructions given by the agents up to 47,838,190 containers, having a total value of \$9,535,552.31.

As no written reports were required from those who received emergency instructions from the home-demonstration agents and other workers, it is difficult to give accurate figures regarding results. Based on a careful calculation and upon such reports as were voluntarily handed in, a conservative estimate of the total number of cans of fruits and vegetables put up would be approximately 200,000,000. This figure is reached by adding to the amount reported from the regular work a very conservative and reduced amount for each woman and girl who undertook to do emergency work. It is very probable that the figures exceed this amount, for the reason that the work reached and assisted a larger number of persons than the emergency enrollment, and those persons had influenced their neighbors and friends.

Besides the canning, the agents, with the help of specialists, instructed the women and girls in home drying of fruits and vegetables, with the result that 5,511,881 pounds of dried vegetables and fruits were stored. They were also instructed in the brining and salting of vegetables, and as a result 1,178,683 gallons of vegetables were saved in this way.

The girls cultivated 11,969 and the women 10,633 winter gardens, while the girls established 842 perennial gardens; 7,079 girls and 12,373 women made bread demonstrations. A number of labor-saving devices have been made, including 4,704 fireless cookers, 3,341 iceless refrigerators, 7,586 flytraps, 920 kitchen cabinets, 986 floor mops, 399 wheel trays, 759 ironing boards, and 8,466 other household conveniences not specified. Fully 12,914 girls and 21,650 women conducted systematic and well-defined cooking demonstrations, using the products grown by club members and the equipment made at home. One thousand water systems have been installed and 79 shower baths; 6,277 houses were screened, and 2,249 driers or evaporators made.

Instruction in butter making was given, and as a result 83,568 pounds of butter were made according to instructions furnished by the Dairy Division of the department, and the following articles of butter equipment were installed: Two hundred and fifty-nine butter

workers, 1,032 paddles, 1,323 molds, 509 thermometers, 461 shotgun cans, 702 barrel churns, and 432 other butter utensils not specified.

There were installed 75 rest rooms, where farm women coming to town can go with their children, and in some cases community kitchens were installed in connection with the rest rooms. One hundred and three egg circles and 39 cooperative breeding associations were organized.

The canning-club girls receive instructions in sewing, and 44,146 caps and aprons, 5,919 dresses, 8,803 towels, 7,010 holders, 6,727 miscellaneous articles, and 57 sewing screens were made. The following short-course scholarships were awarded: Three thousand six hundred and thirty-nine county and 428 State. As already stated, the girls put up 12,844,513 containers of vegetables and fruits. This amount was reported as follows: Vegetables, 7,817,043; fruits, 1,645,916; fruits and vegetables not listed separately, 3,130,241; special pepper products, 83,639; bottles of fruit juice, 14,097, and glasses of jelly, 153,577.

Organization and loyal workers have made such results possible. The program as outlined by the State agents in previous years had comprehended all the different phases of the work needed for growing products, saving them, utilizing them, and adding to the conveniences of the rural home. Demonstrations in home equipment and home arrangement also had been planned. It had been contemplated, too, that demands would develop for suggestions for object lessons in home architecture and beautification. It had been realized early that the climax of the demonstrations would come in the growth of flowers, grass, trees, and shrubbery for the yards and lawns. Success in the food production part of the program must lead to similar success with the advancing demonstrations. When the war broke out, therefore, it was only necessary to stress the fundamental instructions that had already been given, and ask the agents to try to do a little more than had ever been done before along each of the lines of work previously outlined. It was not necessary to add anything new except the drying and brining.

In one State (Kentucky), through the earnest work of the home-demonstration agents, drying demonstrations spread in a short while over the whole State, and 1,800 homemade driers were constructed and 306,000 pounds of dried products were saved.

Of the new features that have been taken up and especially emphasized since the beginning of the war, the home canning of meats, fish, and other sea foods, has proved very valuable. Large quantities of meat and fish that otherwise would be wasted are now preserved. In the canning of meat the importance of saving everything of the butchered animal suitable for food had been kept in mind. Instruc-

tion has been given, not only in the canning of beef, pork, poultry, etc., but also in the canning of game. Agents have learned how to utilize old chickens, broilers, old pigeons, etc., in making palatable dishes, canning them and thereby reducing the food bills. They are utilizing thousands of jack rabbits, as well as common rabbits, as a source of meat supply. Likewise, wild ducks and geese along the Gulf and Atlantic coasts and inland waters have been saved in the same way. In Florida and other Southern States having a large fish supply, agents have been instructed in the canning of fresh and salt-water fish, the canning of oysters, crabs, clams, and other sea foods, and in the canning and drying of shrimp.

The club work began (and still begins in new territory) with teaching the growing and cultivation of a single plant (the tomato) and the utilization of its fruit. From that single beginning it spreads to include instruction in every vegetable and fruit grown in the South, and to embrace not only the household conveniences and labor-saving devices in the home, but also the convenient arrangement of the home itself and its surroundings. Our agents have repeatedly been called on to give help in the planning of the home—the convenient and practical arrangement of rooms and furnishing; the selection of furniture, wall paper, and curtains; the planning of the outbuildings and the landscape gardening around the house.

The following summary of statistics will give definite information in regard to the progress of the year's work and also furnish a good basis of contrast with the activities of 1916:

Summary of canning-club work for the 15 Southern States for 1916 and 1917.

Item.	1916	1917
Number of counties organized	419	715
Number of girls enrolled in canning clubs	37,964	61,589
Number of girls enrolled in poultry clubs	9,656	11,717
Number of girls in emergency enrollment	(1)	980,272
Number of girls making cooking demonstrations	(1)	12,911
Number of girls making bread demonstrations	5,887	7,079
Number of short-course scholarships awarded, county	209	3,639
Number of short-course scholarships awarded, State	623	423
Number of caps and aprons made	23,764	41,146
Number of dresses made	3,875	5,919
Number of miscellaneous articles made in sewing	14,348	22,510
Number of winter gardens	3,172	11,969
Number of perennial gardens established	(1)	842
Total number of containers from one-tenth acre	2,354,854	8,932,738
Total value of one-tenth acre products	\$537,247.55	\$1,511,048.42
Total number containers from farm and orchard	1,054,196	3,961,775

Summary of home-demonstration work for the 15 Southern States for 1916 and 1917.

Item.	1916	1917
Number of women enrolled.....	22, 048	82, 227
Number of women enrolled in emergency work.....	(1)	1, 470, 408
Number of clubs organized.....	1, 042	3, 812
Number of women carrying on demonstrations in cooking.....	12, 729	21, 650
Number of women carrying on demonstrations in bread making.....	(1)	12, 373
Number of fireless cookers made.....	3, 290	4, 704
Number of iceless refrigerators made.....	2, 171	3, 341
Number of flytraps made.....	5, 025	7, 586
Number of wheel trays made.....	293	399
Number of kitchen cabinets made.....	(1)	920
Number of ironing boards made.....	486	759
Number of driers or evaporators made.....	(1)	2, 249
Number of miscellaneous articles made.....	4, 032	9, 452
Number of water systems installed.....	361	1, 000
Number of shower baths installed.....	(1)	79
Number of devices made or purchased in butter work.....	1, 840	4, 718
Number of winter gardens.....	2, 604	10, 633
Number of rest rooms installed.....	101	75
Number of egg circles organized.....	(1)	103
Number of cooperative breeding associations organized.....	(1)	39
Total number of containers of canned products.....	1, 735, 697	34, 993, 677
Total value of canned products.....	\$419, 422. 12	\$7, 042, 137. 63
Total number of pounds dried vegetables and fruits.....	(1)	5, 511, 881
Total number of gallons vegetables brined and stored.....	(1)	1, 178, 683
Total number pounds of butter made under demonstration methods.....	92, 649	83, 568

¹ None reported.

SPECIALISTS.

Each State has maintained its force of specialists. The duties and relations of the specialists to the other extension workers had become much better understood. In practically all cases the specialist and county agent are planning their work cooperatively. This mutual understanding is quite beneficial to them as well as to the work. The specialist gives the agent definite information in matters pertaining to his special line which has been gleaned from the study of results from the field records of the experiment station extension specialist and from demonstration plats. In turn the agent keeps the specialist informed as to the progress of field work and assists him in many ways in establishing a personal touch with the farmers in the field.

Movable schools and short courses are conducted in all the States. These have replaced almost entirely the old farmers' institutes. The specialists have rendered splendid service in this line of work by speaking and giving practical demonstrations at meetings. They have also been of much value in arranging and looking after exhibits at fairs and assisting in the judging of these exhibits. In all the States, 240 specialists are now employed—an increase of 39 during the year.

Dairy.—There were employed during the year 38 dairy specialists in North Carolina, South Carolina, Georgia, Alabama, Tennessee, Mississippi, Louisiana, Arkansas, Oklahoma and Texas. The dairy work in each State is carried out under cooperative agreements be-

tween the State extension divisions and the Dairy Division of the Bureau of Animal Industry. Dairy demonstrations are planned in close cooperation with the county agents and through them much valuable instruction is given to the farmers regarding the proper feeding of the dairy cows, raising of calves, construction of dairy buildings and silos, selecting suitable breeding stock, testing herds, keeping herd records, and care and handling of milk, cream, and other dairy products. One of the most interesting and valuable new features of the dairy work is the establishment of 23 cheese factories in the mountain districts of North Carolina, Virginia, and West Virginia. These give a money income to communities too remote from transportation facilities to make other lines of dairying profitable.

As a result of the improved methods in handling the cream in one instance, the receipts were increased \$2,500 during the year and the quality of butter so improved as to command 2 cents more per pound, or a total increase of \$4,500 during the year. During the year eight cow-testing associations were organized, with 128 members, and 28,055 cows tested by these associations. Five bull associations were organized and assistance given in the purchasing of 237 pure-bred bulls, 387 pure-bred cows, and 1,144 grade cows. Fifty-two farmers were given instructions in building calf stanchions, 169 in constructing and remodeling barns, 65 in construction of milk houses, and 170 in the building of silos; 128 farmers were induced to keep herd records, with a total of 1,760 cows; 131 unprofitable cows were found and sold.

Live stock.—Thirty-eight specialists in animal husbandry were employed cooperatively by the State extension divisions and the Bureau of Animal Industry. These men devote their entire time to assisting and advising the county agents and the farmers as to the best methods for increasing the number and the grade of live stock of all kinds. They have prepared circulars, issued letters, and addressed farmers' meetings, giving the best information obtainable on breeding, feeding, housing, and caring for farm animals. They have also rendered assistance in selecting, purchasing, and marketing live stock. Special efforts have been made in cooperation with the county agents to bring in pure-bred cattle, horses, sheep, and hogs in every State. Campaigns for increasing pork production have been very successful, as is indicated from the relatively large increase in the percentage of hogs sold and the number found on the farm as compared with a few years ago. The sheep industry was pushed in some sections to advantage. The results of this line of work are plainly observed by the general improvement in the animals, the pastures, and the barns, and in the large number of silos which have recently been built.

The work done by the pig-club specialists in assisting the boys to secure pigs and instructing them in the methods of feeding, handling, and disposing of them has been very valuable.

Poultry.—Considerable progress has been made in poultry work. Fourteen specialists are now employed under the cooperative agreements between the Bureau of Animal Industry and the State extension divisions. The larger part of this work is carried on with the women and girls. The poultry specialists, with the aid of the county agents, have done a great deal to improve and increase the poultry output on all farms. Poultry clubs, egg-selling associations, and similar activities have been organized. The club members exhibited birds at the county and State fairs in several States and won a number of prizes in competition with experienced poultry growers.

Agronomy.—This important branch of the work had 28 specialists who greatly aided the county agents and the farmers. They have prepared various circulars and letters giving instruction, established demonstrations, prepared charts for lecture work based upon the information obtained from the results of the experiment station records, results of demonstration plats, and other sources, which have been used by the agents and others in their talks at farmers' meetings. They have also given out valuable information regarding fertilizers, cover crops, proper culture of crops, drainage, and any other topics useful in bringing about greater production.

Another line of work was the effort to get farmers to use better seed for all crops and to give them advice as to the best methods of selecting and saving seed for the following year's planting. Probably the most notable service was rendered in getting large increases in the acreage of legumes, small grains, and forage crops, and in securing the improvement of pastures for live stock.

The agronomy specialists have assisted in all States in the extension schools, farmers' meetings, by lecturing and practical demonstrations. Useful charts, circular letters, and other information were furnished to agents and speakers for the special campaigns that have been carried on in almost every State for the promotion of increased crop production to meet war needs.

Horticulture.—The number of horticultural specialists was increased to 29. Probably more attention is now being given to gardening, trucking, and orcharding than in any previous period. The home orchard and the all-year-round garden have received extra attention. Much time was devoted to setting new orchards and spraying and pruning orchards that had already been established. The farmers and truckers have been helped in many communities in the better grading and packing of their products for the market. The plans and instructions furnished by the horticultural specialists

have been quite helpful to the county agents in pushing these things on the farm and in the schools.

Agricultural engineering.—Ten specialists were engaged in this line of work, which included drainage, terracing, rural sanitation, etc. Their services were valuable, especially in furnishing technical information to the agents and carrying out field demonstrations.

Marketing and rural organization work.—This work was conducted in cooperation with the Bureau of Markets. Altogether 22 specialists were employed in this line of work, under various projects. Valuable assistance was given in organizing communities for mutual benefit. These community organizations are of great assistance to both men and women county agents. Some of the things which have resulted are plans for cooperative buying and selling of products, rural credits, community welfare circles, etc. Valuable service has been rendered in a number of States by these specialists in the marketing of fruits and vegetables, cotton, and other farm products. Instruction was also given in proper methods of grading, packing, and standardizing farm products to meet the requirements of market centers.

Beekeeping.—This line of work was started in 1916, and under a cooperative agreement between the Office of Extension Work in the South and the Office of Bee Culture, Bureau of Entomology, a specialist was appointed, who traveled through 15 States, holding meetings of beekeepers, conferring with extension officials, and in every way possible encouraging the beekeeping industry. It is estimated that the 15 Southern States contain about 40 per cent of all the colonies of bees in the United States, but comparatively little attention had been given to this line of work as a possible source of income to the owners. It was thought by the specialist in this line that there was opportunity for development in this region. In the beginning great interest was shown in the work. From the first there was some work in southern Texas, where beekeeping had already been commercially developed.

After the United States entered the war circulars from the Bureau of Entomology were mailed directly to beekeepers in 14 States, and a special circular of information was prepared and sent to all extension workers. North Carolina and Tennessee were the only two States to put on a special project for this work during the year. As a result a beekeepers' association was organized in North Carolina, with a considerable membership, and the outlook for this line of work in this State is very promising.

In Tennessee a considerable industry already existed in the central part of the State, and the specialist in charge developed these local communities and worked up an interest in other sections where no special attention had been given the subject. Some of the results

seem to point to greater attention being given this important line of work; and no doubt, as the activities of the specialist become better known, it will develop into something really valuable to the State from a direct financial standpoint.

Farm management.—Four farm-management specialists were employed, and work is fairly well organized in 4 different States. A number of surveys were made and the results tabulated are being sent out to the farmers who have agreed to take up demonstrations under this project. The specialist in charge has great hopes that this line of work will develop into something very useful to farmers.

Forestry.—During the year the forestry extension specialist arranged work in Tennessee, North Carolina, and Virginia. Projects were submitted by the department specialist in forestry to the State directors of extension, outlining the objects of the work and plans for conducting it. The main features that received attention were the necessity, advantages, and economy of woodlots on the farm; methods of handling and economizing the timber grown on the woodlots; and the most economical method of improving and maintaining the supply for farm use. Seven definite demonstrations were established—one for planting black locust trees in Tennessee, three for handling farm woodlands in North Carolina, one with a company in Louisiana, two in marketing black walnut in Virginia, and one for handling pine pulp wood in Virginia. Various articles and papers were prepared and published during the year.

The specialist made several extended trips into the field and spent considerable time with a number of county agents arranging demonstrations and giving instructions. He also attended a number of State agents' meetings and delivered addresses outlining his work.

There is a growing interest in this useful line of work and several States have indicated a desire to take it up as soon as proper arrangements can be made.

Interbureau cooperative agreements.—Cooperative agreements were entered into between the States Relations Service and other bureaus for extension work in entomology, forestry, horticulture, plant pathology, dairying, animal husbandry, marketing, and farm management. Under each of these agreements men have been placed in the State extension divisions to carry out the extension work as agreed upon.

More detailed reports of the work of the specialists are given under the several States.

OUTLOOK.

The cooperative extension work in the South has been put to a severe test as an effective organization for handling agricultural problems since the last report. The active entrance of the United States

into the war made it necessary to rearrange all existing plans of work. It was decided by the national and State leaders that increased food production should be the aim of all the combined forces. The county-agent force, being the only effective organization extending throughout the country, was chosen as the medium through which aid and information should be carried direct to the farmer. In addition to the original plans for production and conservation work, a few special campaigns were organized which were to be more or less nation wide, chief of which was a campaign to increase swine production, and one to increase wheat and small grain acreage throughout the country. These campaigns were pushed with vigor and success. In addition to the regular agricultural work, the agents were called upon to participate in all the patriotic work, such as Liberty loan, Red Cross, and War Savings campaigns, food surveys, etc.

The community organizations referred to in previous reports were greatly increased and utilized in this special work to the fullest extent. The response of all the people to the appeals was all that could be desired. As a result of the united efforts, food crops were enormously increased. Perishable crops were saved by canning and drying to a larger extent than ever before. To meet the emergency conditions, many new men and women agents were appointed before the close of the fiscal year and many additional agents will be put on when funds become available.

The extension division in each of the 15 Southern States has grown in strength and in the confidence of the people. The excellent co-operative spirit manifested by all agricultural workers and by the people themselves has been a source of great encouragement to those responsible for the administration of the national agricultural program. The prospect for the further expansion and adoption of the extension methods for the dissemination of useful information to rural people is very promising. The one danger that threatens the effectiveness of the county-agents' work is the scarcity of well-qualified men. The majority of the most valuable agents is subject to draft in the military service. A number have already resigned to join some branch of the service and many more will go unless it is found possible to get recognition for them as performing a military service in their present capacity. The leaders believe that if there is not too great loss of efficient agents, the extension organization will be able to meet the emergencies in each State and perform with credit every duty required of it.

STATE REPORTS.

ALABAMA.

Division of Extension, Polytechnic Institute, Auburn.

J. F. DUGGAR, Director.

Organization and administration.—The general plan of organization of extension work in Alabama is the same as outlined in the previous report. One white district agent was added at the close of the fiscal year. One new project, farm and home conveniences, was added during the year.

The regular plan for conducting field work was necessarily modified, owing to the entrance of the country into war. The major portion of the time of all extension workers was devoted to stimulating production of food crops as a part of the preparedness program. Cordial cooperation was maintained between the extension division and other agencies in the State, as in previous years. A definite understanding was reached with the State department of agriculture, in which the department assumes the functions of regulatory and police work relating to agriculture, and the extension division assumes responsibility for all educational propaganda for increasing production. In the matter of marketing, the State department of agriculture, in accordance with law, acts as the chief agency for bringing together the buyer and the seller, while the extension division serves as the principal agency in the organization of market associations and the dissemination of information relative to methods of marketing and preparation of farm products for market.

Publications.—The extension publications consisted of 6 farmers' leaflets, 8 circulars, and 14 farm and home convenience leaflets, making a total of 28 extension publications. These constituted a total of 265,000 copies and an aggregate of 1,290,000 pages. In addition, 33 articles were supplied as plate matter to 140 weekly newspapers. In August, 1916, a series of extension news letters was begun for the use of the daily newspapers of the State. Of these 78 were issued during the past fiscal year.

Finances.—The following funds were expended for cooperative extension work in agriculture and home economics for the year ending June 30, 1917:

Smith-Lever, Federal	\$49,401.67
State funds.....	39,401.67
United States Department of Agriculture, farmers' cooperative demonstration work.....	45,493.92
United States Department of Agriculture, other bureaus	10,834.11
County (not used as Smith-Lever offset).....	25,012.40
Other funds.....	5,192.48
Total	175,336.25

Smith-Lever funds were used in support of the following projects: Administration, printing and distribution, county agents, home economics for negro women and girls, extension schools and farmers' courses, boys' club work, girls' club work, pig-club work, poultry-club work, agronomy, community programs, dairy extension, negro men agents, agricultural engineers, beef cattle, marketing, and farm and home handicraft.

Funds from the United States Department of Agriculture were used in support of the following projects: Administration, home economics and girls' club work, boys' clubs, pig clubs, poultry, dairying, and live stock, negro men and boys, and negro women and girls.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—Sixty-seven agents were employed in county-agent work at the beginning of the year, and at the close of the year 72. The most extensive single line of work carried on by county agents was field-crop demonstrations. A very large part of the agents' time during the past year has been devoted to increasing food production, with most gratifying success. Among some of the larger items was an increase of approximately 1,000,000 acres of corn, 750,000 acres of peanuts, and 1,500,000 acres of velvet beans.

The following is a summary of some of the activities of the county agents during the year: Two thousand one hundred and seven meetings were addressed, with a total attendance of 101,690; 817 field meetings were held, with a total attendance of 9,277; 21,799 letters were written in the interest of demonstration work; 775 articles were prepared for publication; 61,569 copies of bulletins of the United States Department of Agriculture and 22,161 copies of bulletins of the Alabama Polytechnic Institute were distributed; 1,260 schools were visited to organize boys' club work; 96 agricultural courses were outlined for farmers' clubs; 71 extension schools for farmers were conducted, with a total attendance of 5,553; 204 clubs were organized, with a membership of 8,088. Demonstrations were made with 196 home fruit orchards; 3,835 trees were pruned and 630 trees were sprayed by county agents in giving demonstrations; 363 dipping vats were built; county agents assisted in dipping 300,492 head of cattle; 176 silos were constructed; 101,863 demonstrations of winter cover crops were made; 10,972 demonstration gardens were planted; 3,440 demonstration terraces were built; 1,542 demonstrations in farm drainage were made; 149 demonstration home lighting systems were installed; 188 demonstration woodlots were improved; 420 demonstrations were made in truck crops; 1,619 demonstrations were

made in corn, with an average yield of 33 bushels per acre; 879 in cotton, with an average yield of 895 pounds of seed cotton per acre; 790 with oats, with an average yield of 29 bushels per acre; 503 with wheat, with an average yield of 13 bushels per acre; 551 with rye, with an average yield of 18 bushels per acre; 115 in alfalfa, with an average yield of 4,500 pounds per acre. Six thousand one hundred and forty-three farmers were induced to select their planting seed in the field. One thousand seven hundred and thirty-two pure-bred hogs and 984 sheep were brought in; 243,143 cattle were treated for blackleg and other diseases, and 158,040 hogs for cholera and other diseases.

Club work.—All lines of boys' club work are now included in one project. Boys' clubs were organized in each of the 67 counties of the State. The enrollment was as follows: Corn clubs, 4,660; potato clubs, 61; cotton clubs, 336; peanut clubs, 51; pig clubs, 3,460; miscellaneous clubs, 1,636. The average yield of boys reporting in corn clubs was 46.4 bushels per acre, at an average cost of \$0.41 per bushel. Two hundred and forty-seven community boys' clubs were organized. Short courses for members of boys' clubs were held in 20 counties. A State short course was held at the agricultural college, with an attendance of 125 boys from every part of the State.

Pig clubs.—Pig-club work was conducted in cooperation with the Bureau of Animal Industry; the enrollment was 3,460. The majority of the members secured pure-bred pigs. The net profit made by the boys in the pig clubs was \$12.31 per head when grown for pork and \$24.48 per head in animals grown for breeding purposes. The average profit where grazing crops were used was \$14.23; where grazing crops were not used, \$9.37 per head.

Negro work.—From the beginning it has been the duty of all white agents to carry negro demonstrators and by this means it has been possible to give a great deal of assistance to negro farmers. One negro district agent and 9 negro local agents were employed in Alabama during the year. The work under this project is conducted along exactly the same lines as are followed in conducting demonstration work among white people. In addition to the work done by negro agents, the specialists of the State extension division have assisted in holding farm schools for negroes throughout the State. The negro demonstration work is carried on in cooperation with the Tuskegee Institute, and the district agent having charge of the work among negroes makes his headquarters at this institution. The negroes have responded generously to the call to produce more food crops as a war emergency. The following are some of the results accomplished through the influence of negro agents: Forty-six county wide agricultural campaigns were carried on; 226 demonstration field meetings were held; 22 community fairs were held for

negroes; demonstrations with small grain numbered 1,138, with terraces, 4,029, with orchards, 437; the number of clubs organized among negro farmers was 97, of live stock purchased through agents' advice, 351; letters written, 3,933; people reached through demonstrations, meetings, and otherwise numbered 75,000; cans and jars of fruit and vegetables were put up under the instruction of agents were 9,135, and cooking demonstrations given, 35.

Home-demonstration and girls' club work.—The home-demonstration work was organized in 29 counties, with the result that 4,595 girls were enrolled in the garden and canning clubs, 87 in poultry clubs, 864 in winter-garden clubs, 1,264 in cooking clubs. The girls in the canning clubs put up 390,624 cans of vegetables in tin and 195,512 glass jars of vegetables from their home gardens. Members of the girls' clubs also put up 68,000 cans and jars of fruit from the home orchards.

The enrollment of women in the home-demonstration work was 2,818; clubs organized, 142. There were 298 demonstrations with farm women in poultry management, 2,108 in cooking, 1,283 in bread making, and 1,252 in making winter gardens; 315 fireless cookers, 56 iceless refrigerators, 26 kitchen cabinets, 4 wheel trays, and 151 ironing boards were made; 36 houses were screened, and 9 rest rooms installed in towns for farm women. The total number of containers of fruits and vegetables packed by farm women was 1,538,194; the dried fruit and vegetables stored were 124,601 pounds, and brined vegetables stored, 16,284 gallons. The above represents only the results of direct demonstrations. The influence of this work reached, either directly or indirectly, every part of the State and resulted in having the largest amount of fruits and vegetables stored for home use that had ever been put up in one year. The campaign for home gardens was very successful. An average of 77 demonstrations were given by the agents for each county in the State. These demonstrations were attended by 138,146 people. A total of 3,928 meetings were held for farm women, with a total attendance of 219,724 persons.

Agronomy.—A specialist in agronomy is employed to give instructions to county agents and farmers and to assist in holding extension schools. He attended more than 100 meetings during the year, with an attendance of 7,974 people. He has assisted the director of extension in caring for part of the agricultural correspondence and in the preparation of extension bulletins and circulars. He supervised during the year the preparation of plate material, and issued 55 news letters to the papers of the State.

Dairying.—The dairy specialist was employed jointly by the extension division and the Bureau of Animal Industry of the United States Department of Agriculture. The work under this project has con-

sisted in giving advice to the creameries of the State on the best methods of butter making, organizing cream routes, encouraging the purchase of better dairy animals, and assisting in holding meetings and giving demonstrations to instruct farmers how to make a better grade of butter on the farm. Eighty-eight public meetings were addressed during the year, with a total attendance of 5,928 people. A total of 1,075 official letters relating to dairying were written. Eleven creameries are operating in Alabama, so distributed as to furnish a good market for cream to the farmers in all parts of the State. It is estimated that 56,700 pounds of butter were produced in Alabama creameries during the year.

Beef cattle.—A specialist is employed under this project in cooperation with the Bureau of Animal Industry, United States Department of Agriculture. The work has been conducted in the tick-free area of the State. The following is in brief the work accomplished: Assisted in placing 346 head of pure-bred cattle at an average price of \$212 per head; organized baby-beef clubs in 8 counties; supervised 7 cattle-feeding demonstrations, with a total number of 683 cattle fed under instructions; gave specific instructions in the care and management of herds to 128 farmers; wrote 652 letters of an official nature; issued 4 circular letters; prepared 11 articles for newspapers; mailed out 1,600 bulletins; addressed 91 farmers' meetings, with a total attendance of 345. The beef-cattle industry is growing in Alabama, and the services of the specialist of this division have been in constant demand throughout the year.

Marketing.—A specialist is employed cooperatively by the State extension division and the Office of Markets, United States Department of Agriculture. The principal line of work undertaken was the organizing of farmers for cooperative shipments of live stock. This work was started in four counties in southeastern Alabama in the fall of 1916. The farmers were encouraged to bring their live stock to a central shipping point, where buyers from leading packing-houses were invited to be present to bid on animals offered. This work proved very successful and was extended to other counties in 1917. During the year 24 hog-selling associations were organized. Through these associations the farmers have been able to realize from 1½ to 2 cents a pound more for their hogs. In addition to the above work, 14 meetings were held in the interest of better marketing of staple farm crops.

Agricultural engineering.—A part-time specialist in agricultural engineering was employed. The work consisted mainly in furnishing plans for farm buildings and home waterworks and laying out systems of farm drainage. The following summary gives the leading items of work accomplished: Number of letters written, 1,480; trips made to advise with farmers, 41; blue prints of farm buildings

sent out to farmers, 82; blue prints of farm buildings furnished to county agents, 500; water systems installed in farm homes, 41; plate service articles prepared, 5; surveys for fish ponds, 2; publications, 2. A growing interest is evident among farmers of the State in erecting the most approved types of farm buildings, and the services of the specialist in this department have been in great demand during the year.

Educational and demonstrational work with hog cholera.—This work was carried on in cooperation with the Bureau of Animal Industry, United States Department of Agriculture, and in cooperation with the State veterinarian. The specialist visited a number of counties and gave advice in regard to the prevention of hog cholera and the importance of organized community action to control this disease. The work done by the specialist, in cooperation with the county agents, has been responsible, in a large measure, for controlling hog cholera in the State, with the result that the number of hogs raised for home use and for market has increased largely.

Movable schools.—Most of the movable schools held in Alabama during the year among the white farmers have been short courses held for members of the boys' and girls' clubs. The program outlined for these club schools has been such that they were attractive to farmers as well as club members. In consequence, a large number of farmers and farm women have attended these club schools—possibly as many as would have attended if they had been planned exclusively for the adult farmer. Nineteen of these club schools were held during the year. In addition to the movable schools held for boys' and girls' clubs, a large number of one-day farmers' meetings were held throughout the State.

Movable schools for negro farmers were also held in sections where they were most needed. Fifty-one meetings were held for negro farmers, with a total attendance of 16,237.

Other extension activities.—Arrangements were made during the fiscal year for utilizing in the extension work a small proportion of the time of the heads of some of the divisions of the college and experiment station. This was done in order to utilize their services in extension correspondence, in occasional meetings, and in giving expert advice to county agents or other full-time extension employees.

The department of horticulture conducted an extensive correspondence on orcharding, trucking, and other horticultural subjects and a number of extension addresses were delivered by the college horticulturist.

The head of the department of animal industry of the college and experiment station devoted a small part of his time to extension

work. This consisted chiefly in the writing of 680 letters, and of consultations with the dairy and live-stock extension specialists in outlining plans of work.

The instructor in entomology of the college assisted in holding 42 extension meetings, with an attendance of 5,776 farmers. He also wrote 2,000 letters to farmers, giving advice on subjects pertaining to entomology.

The instructor in agricultural engineering of the college devoted a part of his time to getting out literature on farm and home conveniences, which was furnished to county agents and farmers.

OUTLOOK.

A larger number of farmers have been reached through the extension work during the year than in any previous year. It has reached during the year, either directly or indirectly, more than 300,000 people. The war emergency campaign for the increasing of food production in Alabama was very successful. The corn crop was increased more than 50 per cent, and the acreage in soy beans, peanuts, and velvet beans was increased at least 100 per cent. There was a very large increase in the number of hogs, dairy cattle, beef cattle, and poultry. The planting of home gardens was practically State wide.

ARKANSAS.

Division of Extension Work, College of Agriculture, University of Arkansas,
Fayetteville.

WILLIAM C. LASSETTER, *Director.*

Organization and administration.—There was no change in the general plans or policies of extension work in Arkansas during the year. Early in April a general conference was called in response to the request of the National Government for consideration of the program for increasing food production and food conservation. The work was thoroughly organized in every county in cooperation with other State forces, councils of defense, and other local organizations, and meetings were called in every community to discuss war measures, and to outline in detail plans to meet local conditions. The leaders of the extension work had the cordial support of every institution and organization interested in the agricultural resources of the State in pushing the campaign for increased production to a successful end. The results show a remarkable increase in all crops, and especially food crops, such as wheat, potatoes, truck and garden crops. The increase in corn production alone amounted to about 21,000,000 bushels. Everyone exerted the utmost energy to make the

State self-sustaining. The extension forces also rendered excellent service to the organized committees in the various counties and communities in pushing the campaigns for the Red Cross, Liberty Bond sales, and other purposes.

Director J. H. Miller resigned and was succeeded by W. C. Lassetter as acting director, who, at the beginning of the new fiscal year, became director. Two new district agents were appointed for men's work and one for women's work. Miss Isabelle Thursby succeeded Miss Marcella Arthur, specialist in home economics. W. A. Denman and D. R. Forrester, specialists in animal husbandry, and Earl Kilpatrick, specialist in agronomy, resigned. R. G. Scriber was appointed specialist in hog-cholera work, J. F. Nicholson specialist in marketing. There were some changes in both men and women county agents. At the end of the year the organization consisted of the director, State agent for men, State agent for women, assistant State agent in club work, 5 men, 1 woman and 1 negro district agents, 63 county agents, 45 women agents, 5 negro agents, and 8 specialists. This shows an increase in the force of 4 administrative officers, 6 county agents, 13 home-demonstration agents, and 4 negro agents, and a decrease of 1 specialist.

There was no official agreement with the other institutions of the State, but a friendly working relationship was maintained with the State department of agriculture, State department of instruction, State board of health, agricultural commissioners of railroads, bankers' associations, chambers of commerce, the profitable farming committee, the agricultural high schools, State dairymen's associations, State horticultural association, State cattlemen's association, State swine-breeders' association, the county quorum courts, and other local organizations. In the general campaign for increased food production all of these organizations furnished speakers without cost to the extension division, except for actual travel expenses in some cases. The newspapers have rendered valuable assistance by giving space for information and the advertisements of the campaigns. The Arkansas bankers and business men have supported the work by contributing prizes and scholarships for the boys' and girls' club work. The quorum courts continued their support of the work by materially increasing the appropriations for the support of the county agents. This has made it possible to increase the salary of county agents, and of course this meant the securing of better qualified people for this work. The director still makes his headquarters at Fayetteville, but the State agent and practically all the field force maintain headquarters at Little Rock. The office equipment is sufficient for the present needs of the organization.

Publications.—The use of agricultural free plate was continued. This was distributed to an average of 120 papers at the rate of a

column per week. To promote better marketing facilities for the farmers a monthly marketing bulletin was published in which were listed products for sale in the hands of the farmers and a list of the farmers' wants. The other extension publications consisted of circulars, leaflets, posters, and mimeograph material, sent out to different workers. Seventeen publications were issued during the year, with a total of 121 pages and 486,500 copies.

Subject matter for the circulars and bulletins was submitted to the heads of the divisions of the college for approval of all technical questions. The publications were prepared in a popular and practical style to meet the needs of farmers and club members. Publications were usually sent in bulk to the agents and, through them, distributed to the people. A mailing list of bankers, prominent farmers, and others interested is kept in the director's office, and any available literature is sent out to other persons on request. The extension editor has charge of the preparation of publications and press material.

Finances.—The work was financed from the following sources:

Federal Smith-Lever.....	\$40, 577. 08
State Smith-Lever.....	30, 577. 08
United States Department of Agriculture, farmers' cooperative demonstration work.....	39, 835. 92
United States Department of Agriculture, other bureaus	8, 764. 33
County appropriations.....	71, 139. 45
Private subscriptions.....	6, 663. 28
Total	197, 557. 14

Smith-Lever funds were used in support of the following projects: Administration, publications, county agents and boys' club work, pig clubs, home demonstration and girls' club work, specialists, curing and marketing of meats, beef-cattle introduction, marketing, and farm management. United States Department of Agriculture money was used for administration, county agents and boys' club work, home demonstration and girls' club work, curing and marketing of meats, beef-cattle introduction, marketing, and farm management.

SMITH-LEVER PROJECTS:

County agents.—The progress in county-agent work during the year was quite satisfactory. The county agent is now looked upon as the real leader of all agricultural extension activities in his county. Every agent is now required to work under definite plans agreed upon in conference with his supervising agent and specialists where they are concerned in particular work for the county. Records of results are obtained only from listed demonstrations, but it is con-

servative to say that ten times as many farmers are using demonstration methods. In fact, the influence of the work is felt on almost every farm in counties where there has been a good agent for several years.

A brief summary of some of the activities of the county agents will give an index as to the extent of the work: There were listed 1,592 corn demonstrations on 17,473 acres, yielding 37.2 bushels per acre, or an increase of 12.8 bushels per acre over ordinary methods. It is estimated that 160,850 farmers were influenced to use better methods in corn production, which resulted in an increase of 21,000,000 bushels; 880 cotton demonstrations on 18,000 acres, average yield 995 pounds of seed cotton per acre; 314 oat demonstrations on 3,531 acres, average yield 47.9 bushels per acre; 291 wheat demonstrations on 2,375 acres, average yield 24 bushels per acre; 178 demonstrations in rye, 191 in alfalfa, 316 in cowpeas, 142 in soy beans, 279 in velvet beans, 124 in peanuts, 167 in sweet potatoes and 640 in Irish potatoes. The agents helped in starting 117 orchard demonstrations with 11,862 trees, and rendered assistance in the pruning, spraying, and other treatment of 170,804 trees. Pure-bred animals brought into the State through the influence of the extension workers were: 368 horses, 1,245 dairy cattle, 2,483 beef cattle, 4,097 hogs and 680 sheep. There were 156 poultry demonstrations with about 5,000 birds.

There were constructed through the influence of the work 247 dipping vats, making a total of 1,144 in the State; 8,135 cattle were treated for blackleg, 2,450 for charbon, and about 200,000 hogs were treated for cholera. The agents assisted and advised in constructing 305 silos, 456 new buildings, 629 buildings improved, 306 plans furnished for new buildings, 154 waterworks, 130 lighting systems, 2,264 houses screened, 26 telephone systems, 2,835 new pastures, 430 old pastures renovated, 359 drainage systems started, stumps removed from 510 farms, 1,963 terraced land, 19,479 home gardens, 26,216 farmers who put up surplus products for winter use, 1,194 farmers who planted cover crops, 410 who used lime, and 2,741 were instructed in the use of fertilizers.

New machinery purchased: 159 binders, 411 mowers, 429 rakes, 203 presses, 184 drills, 67 ensilage cutters, 390 gas engines, 516 disk harrows, 218 cream separators, 1,151 two-horse cultivators, 14 tractors, 60 spraying machines, 67 feed mills, and a large number of smaller implements.

New community organizations, 267, membership 6,197; visits made to demonstrators, cooperators, club members, and others, 56,657; miles traveled, 270,013; calls at office for information, 37,310; farmers' meetings held under the auspices of agents, 3,997, attendance 86,972; field meetings held, 1,270, attendance 12,407; official letters

written, 24,045; articles prepared, 1,212; circular letters sent out, 640; printed matter distributed, 111,721 department and 36,767 college publications.

Boys' club work.—The boys' club work was supervised by an assistant State agent in club work, who is assisted by the specialist in pig-club work and the county agents, who are all required to help in club work. The total enrollment in boys' agricultural clubs was 7,748, classified as follows: Corn club, 2,514; potato, 941; cotton, 553; peanut, 314; pig, 2,781; poultry, 195; and miscellaneous and emergency enrollment, 1,750. The enrollment in the farm-makers' clubs for negro boys was 1,830, making a grand total of 10,878. The average yield of boys reporting in corn clubs was 47.1 bushels per acre, at a cost of 34 cents a bushel. Six boys made more than a hundred bushels. The average yield of potatoes was 107.4 bushels, at 47 cents a bushel. The average yield of peanuts was 39 bushels per acre, at a cost of 42 cents a bushel.

In pig clubs the net profit per pig in the breeding demonstrations was \$23.07; in the sow and litter demonstrations the net profit was \$23.75. The average profit made by members using grazing crops was \$40; not using grazing crops, \$15. In 1917 a beginning was made in organizing community boys' clubs, and 150 of these clubs were organized. Short courses in agriculture were held for the boys. Exhibits were made by boys at county fairs.

Negro work.—Four local negro agents were appointed and supervised by the negro district agent. They work among the negroes only. All white agents are required to give instruction to negro farmers in counties where there is a large negro population. The progress in the work among negroes is very satisfactory. The following shows some of the activities of the district and local negro agents: The district agent reports having traveled 16,236 miles; made 294 visits; attended 150 meetings, with an attendance of 16,875; enrolled 50 corn demonstrators, who made an average yield of 42 bushels per acre; 49 cotton demonstrators, with an average of 1,200 pounds of seed cotton per acre; and 20 orchard demonstrators; assisted in terracing 5 farms; assisted in building 11 dipping vats; organized 50 community clubs with a total membership of 2,500. A summary of the work of local negro agents is 272 corn demonstrations on 1,000 acres, with an average yield of 38 bushels per acre; 222 planted selected seed corn; 546 selected seed corn for another year. The total number of negro corn growers assisted by the agents was 2,500. There were 149 cotton demonstrations, with an average yield of 700 pounds of seed cotton per acre. Assistance was given 1,121 other cotton farmers. There were 25 wheat demonstrations, 26 oat demonstrations, and a large increase in the acreage of cowpeas, soy beans, potatoes, and other food crops. Five thousand

one hundred and sixty-four demonstrators and other farmers were visited; 1,006 club members were visited; total miles traveled, 7,797; 224 meetings were held for the negroes, attendance 14,703; and 45 field meetings, attendance 287; 141 schools were visited in the interest of club work. Five hundred and forty-two negro farmers were raising practically all their home supplies; 150 carried bank accounts; 150 pastures were started; and 175 were growing legumes for hay.

Home demonstration and girls' club work.—The home-demonstration work is well organized. A closer cooperation perhaps exists between the men and women county agents than in any other State. While the girls' canning-club work was carried forward with the same progressive spirit as heretofore, much more time was devoted to the home-demonstration work among the farm women. Owing to the special campaign, made necessary by the war emergency work, it was impossible to give the same detailed attention to the clubs and other special work as has been customary in the past. Among the women, bread making by communities was carried on, drying demonstrations were given in practically every county where vegetables and fruit were grown, 10 counties had butter work, and 5 agents had equipment for making demonstrations in dairy work. Home-demonstration work was organized in 45 counties. Practically all the agents now are employed for the entire year.

The negro women and girls' club work was conducted under the supervision of one district agent and six emergency agents put in the field for three months. This work made excellent progress, especially in organizing clubs among the negro women and girls, in which lessons were given in cooking, caring for homes, on general sanitary conditions, and in the use of labor-saving utensils. As a result of the work, many of the houses and barns were whitewashed and repaired and general improvement was noted about the negro homes. Girls enrolled, 1,191; women, 930; 55 girls' clubs were organized, and 50 women's clubs. Two hundred and twenty-nine meetings were held for the girls and 200 for the women. The total attendance was 9,250. The number of letters of instruction sent to club members was 255; bulletins and circulars, 4,305. Number of bulletins and letters sent to others interested, besides club members, 2,000. Ninety-seven canning, 15 cooking, and 28 sewing demonstrations were given. The total number of containers filled at these demonstrations by the girls and women was 6,287. The total number of quarts canned by girls and women as a result of the work was 24,068; jars of jelly, 945; preserves, 291. Vegetables dried, 955 pounds; fruit dried, 4,802 pounds. A great quantity of other things, such as sauerkraut, pickles, and chow-chow, were put up under the instructions of these negro women agents.

Specialists.—Eight full-time specialists were employed during the year. Cooperation between the specialists and the county agents is becoming more cordial. The specialists' advice and assistance is helpful, and the cooperative demonstrations in a number of the counties have been successful. A considerable portion of the time of the specialists was devoted, as in previous years, to extension schools and farmers' meetings. They also rendered valuable service in the food campaign early in the spring.

Agronomy.—The specialist in agronomy resigned in November, 1916, and no one was appointed in his place. The director and the agronomy men of the college and station looked after the work to some extent. The plans, which had already been mapped out, however, were carried through by the county agents, and circulars on crops were prepared by members of the force for use in this line of work.

Dipping-vat construction.—The specialist in dipping-vat construction resigned March 15, 1917, to engage in work under the State veterinarian. A large number of meetings were held during the year in sections more or less indifferent to the tick-eradication movement. At these meetings the necessity for the elimination of this pest was explained in detail to the people. The specialist assisted the county agents and farmers in various localities by furnishing blue prints and personal assistance in the construction of vats. The sentiment for State-wide tick eradication is growing rapidly, and there is hope that in the near future the entire State will be tick free.

Live stock.—The work under this project is in cooperation with the Bureau of Animal Industry, United States Department of Agriculture. The specialists in live-stock extension work heretofore had spent most of their time in the encouragement and promotion of better live stock for the farm. One of the special lines was beef cattle, but in the fall a campaign was put on for increased hog production. Valuable assistance was rendered to the cattlemen who wished to secure pure-bred breeding stock, as well as furnishing information and general assistance to the agents and farmers when requested. Owing to the serious drought in Texas, plans were developed for moving a lot of cattle from this section into the tick-infested territory of Arkansas. In line with the national campaign, landowners in Arkansas were interested in securing a considerable number of grade stock from this territory for breeding purposes. More than 20,000 were brought into the State under these conditions. In the conference to consider increased hog production it was decided that Arkansas should increase her number 20 per cent, or about 300,000 head. This campaign was also placed in charge of the live-stock specialists; with the assistance of the county agents and other members of the extension force a well-organized campaign was put on

throughout the State, and the result at the present time would indicate that the full requirements for the increase would be met. There has been a marked change in the attitude of the business men and the best farmers toward the live-stock industry in the State. The bankers are willing to advance money on live stock and to encourage it in many ways. On the whole, the sentiment with reference to the increase and improvement of live stock is exceedingly good.

A summary of the live-stock work is, briefly, as follows: Meetings attended, 206; total attendance, 15,207; personal conferences with bankers and farmers, 153; articles written, 30; letters of information, 800; registered cattle brought into the State, 641; hogs, 34; attendance at fairs and judging live stock, 6.

Horticulture.—The specialist in horticulture covers a very wide field, ranging from truck growing to all kinds of fruit production. His work has been principally confined to the fruit-growing section of the State. He has, of course, furnished information and instruction through publications and otherwise to the county agents and others interested in horticultural work. His services were utilized in the emergency campaign for increased food production, and he made a special effort to encourage home gardens. In addition to this, however, he has been able to continue his regular line of demonstrations which were established last year. Among these a considerable number of new peach orchards were set. He has given numerous demonstrations in pruning, spraying, and the proper culture of all kinds of orchards. He arranged to locate 17 demonstration orchards in the State, and winter pruning demonstrations were put on under the direction of the specialist. He also rendered valuable assistance in instructing the farmers how to free their orchards of the borer. He has also been able to render assistance to the growers of strawberries, cantaloups, beans, and potatoes, especially sweet potatoes. A number of sweet-potato storage houses have been built already and plans for others are under way.

Home economics.—Two-day classes in home economics were held in many towns and villages. Home-economics clubs were continued and others organized. Thirty-two-lesson outlines were prepared and furnished to these clubs. Weekly reports received from the leaders of the home-economics clubs early in 1917 indicated that there was much interest in this sort of work. This line of work was favorably received in both the town and the country. As a result, home-economics departments have been established in many of the high schools.

Marketing.—The marketing specialist works under the cooperative arrangement with the Bureau of Markets. He rendered valuable assistance to the people of the State in the better handling of farm products. By keeping in touch with the leading markets, it was pos-

sible to place many farm products at much better prices than usual. Monthly market bulletins were issued, giving a list of products for sale on farms, also a column of wants. He has aided fruit growers to grade, pack, handle, and market their products so as to get more returns.

Work in the curing and marketing of meats was continued. There was an increased interest in the home curing of meats and use of cold-storage plants. About 16 ice factories gave attention to this work. The specialist, in addition to giving assistance to the ice men, met with farmers at every opportunity to discuss the methods of growing and finishing hogs necessary for producing the best quality of pork and to teach them the best methods for curing meat. As a result of the work, farmers with a small number of hogs could take them to the ice plant and market them to advantage. Some attention has been given to the handling and marketing of other farm products, such as peanuts, sweet potatoes, etc. The work carried on under this project now is included in the general cooperative marketing project.

Farm management.—During the fiscal year a cooperative agreement was entered into between the extension division and the Office of Farm Management. The main feature of the work in 1917 was the taking of farm business records in four typical communities of the State and giving back to the farmers helpful material based on the records. These studies covered 70 cotton farms in the hill section of Pulaski County, 50 in Columbia County in southwestern Arkansas, 50 in Washington County in the Ozark region, and 50 in Lee and Phillips Counties in eastern Arkansas. The county agents rendered substantial assistance in securing these records. As soon as possible the records from each community were itemized and statements of receipts and expenditures sent to each of the farmers. These statements were followed later by comparison sheets which enabled each farmer to compare his business with the average of the community. The specialist has prepared manuscript for bulletins on farm-management subjects, and has assisted in procuring data on the cost of production of milk in the dairies adjacent to the Little Rock territory.

OTHER PROJECTS.

Arrangements were made with the National Implement & Vehicle Association for employing a specialist in farm machinery and implements. Funds were furnished and the director selected the man for carrying on the work, who served until December 15, when he resigned to enlist in military service. He conducted several demonstrations in the use of improved machinery, which were well-attended. Under the stress of labor shortage it is realized by all parties con-

cerned that the farmers must resort more to the use of improved machinery in conducting their work.

A summary of the activities of the implement specialist is as follows: Visited 54 county agents, spending about three days with each; traveled more than 20,000 miles; conducted 47 field demonstrations with sulky plows, cultivators, and general preparation of seed bed; sent out four circular letters to county agents, 5,000 letters to club members, and 400 letters in answer to general inquiries; delivered 40 lectures on implements, with a total attendance of 5,168; prepared 12 articles for publication, also 2 posters; visited 124 implement dealers and held various conferences with the extension workers, and attended the agents' meetings, where talks on improved implements were delivered.

Extension work in hog-cholera control.—During the fiscal year this work was conducted in accordance with an agreement between the Bureau of Animal Industry and the State veterinarian. The Bureau of Animal Industry furnished the specialist and paid his salary and travel expenses. The State serum plant supplemented this work by employing two additional workers. Beginning with May, the extension division and the State department of veterinary science entered into an agreement to cooperate in hog cholera control work. A qualified veterinarian was employed, receiving a part of his salary from the extension division and the remainder from the department of veterinary science. His time is devoted entirely to assisting county agents in hog-cholera control and the stamping out of other infectious and contagious diseases of live stock.

Drainage work.—The Office of Public Roads and Rural Engineering has maintained in Arkansas a drainage engineer who works in very close harmony with the State forces, but there has been no official agreement regarding this work. The extension division furnished office room, heat, light, and janitor service to the representative of this office. The representative cooperates closely in connection with this phase of the work and has rendered valuable assistance to the extension forces and the county agents from time to time.

OUTLOOK.

The extension work in Arkansas made constructive progress during the year. Effective cooperation among all the extension workers was established. The support and encouragement from all other sources within the State indicates that the service is appreciated as a whole. The extension force is pledged to use all available means to strengthen the lines of work already in progress and to exert every effort to enable the State fully to meet its obligations to the country in the present emergency.

FLORIDA.

Extension Division, College of Agriculture, University of Florida,
Gainesville.

P. H. ROLFS, *Director.*

Organization and administration.—The general plan of administration of extension work remained the same as in the previous year. The plans for conducting field work were considerably modified during the year, in order to meet the emergency caused by the entrance of the country into war. A large part of the efforts of both the county agents and home-demonstration agents has been devoted to increasing food production and conservation. A. P. Spencer, formerly district agent for south Florida, was made assistant director January 1, 1917, and H. S. McLendon, formerly county agent for St. Lucie County, was appointed district agent for south Florida. E. S. Pace, district agent for north Florida, resigned February 15, 1917, and E. W. Jenkins, formerly a county agent in Alabama, was appointed district agent for north and west Florida. On July 1, 1916, Miss Harriette B. Layton was appointed district home-demonstration agent for west and north Florida and Miss Sarah W. Partridge was appointed district home-demonstration agent for east and south Florida. Six additional county agents were appointed under the project for negroes March 1, 1917. Seven additional white men county agents were added to the force during the fiscal year. Three new home-demonstration agents were appointed during the year. No specialists have been employed in the extension force in Florida up to this time, and all the funds received have been devoted to strengthening and enlarging the force of county agents and home-demonstration agents.

Very cordial relations exist between the extension division and the experiment station and the college of agriculture. Both the station and the college have been especially helpful in giving aid to the extension division. Cordial cooperation has been maintained between the extension division and other agencies in the State as in previous years.

Publications.—Three bulletins were published and distributed by the extension division during the year, with a total of 45,000 copies. Two reports on cooperative extension work were issued with a total of 10,000 copies. One poster was issued and distributed, with a total of 3,000 copies. Publications of the college and experiment station and of the United States Department of Agriculture were freely used in the State extension work. Bulletins of a general nature are distributed to a select mailing list kept in the director's office. A large supply of bulletins is furnished to each agent, who distributes

them among farmers as needed. Poster bulletins are sent to agents, to be put up in conspicuous places.

Finances.—The following funds were expended for cooperative work in agriculture and home economics for the year ending June 30, 1917:

Smith-Lever, Federal.....	\$21, 892. 73
Smith-Lever State.....	11, 892. 73
United States Department of Agriculture, farmers' cooperative demonstration work.....	23, 328. 70
Other bureaus.....	3, 329. 92
State appropriation.....	12, 486. 11
County appropriation.....	38, 153. 84
Other sources within the State.....	3, 417. 71
Total.....	114, 501. 74

Smith-Lever funds were used in support of the following projects: Administration, printing and distribution, county agents, home economics, boys' clubwork, and negro youth.

Funds from the United States Department of Agriculture were used in support of the following projects: County agents, boys' clubs, home economics, and negro boys' clubs.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—There were 32 agents at the beginning of the year and 39 at the close; number of negro agents employed at the beginning of the year, 1, and at the close 7. County agents bend all possible energy toward getting farmers to increase the production of food and feed crops. A large number of meetings were held throughout the State, especially for the purpose of stimulating food production. Much attention was also given, as in previous years, to field crop demonstrations.

The following is a summary of some of the activities of the county agents during the year: Number of farmers' meetings held, 674—total attendance, 49,280; field meetings held, 174—total attendance, 6,040; official letters written, 16,804; number of articles prepared for publication, 755; number of circular letters issued, 13,323; United States Department of Agriculture bulletins distributed, 32,998; bulletins or circulars from State sources distributed, 8,504; number of schools visited to organize club work, 531; number of short courses for farmers conducted, 19; demonstrations with corn, 598, average yield, 31.5 bushels per acre; with cotton, 106; average yield, 1,341 pounds of seed cotton per acre; oats, 92, average yield, 26 bushels per acre; rice, 25, average yield, 39 bushels per acre; rye, 34, average

yield, 11 bushels per acre; sorghum, 61, average yield, 4 tons of cured hay per acre; Sudan grass, 70, average yield, $2\frac{2}{3}$ tons of cured hay per acre; millet, 43, average yield, $1\frac{1}{2}$ tons of cured hay per acre; Natal grass, 29, average yield, $1\frac{3}{4}$ tons of cured hay per acre; Rhodes grass, 13, average yield, $1\frac{1}{2}$ tons of cured hay per acre; crab grass, 15, average yield, $1\frac{1}{4}$ tons of cured hay per acre; bur clover, 4; velvet beans, 138, average yield, 18 bushels per acre; soy beans, 10, average yield, 12 bushels per acre; peanuts, 93, average yield, 32 bushels per acre; cowpeas, 68, average yield, 15 bushels per acre; sweet potatoes, 131; Irish potatoes, 25; care and management of citrus groves, 57.

Number of pure-bred stallions introduced through agents' influence, 2; jacks introduced, 3; number of brood mares, 99; pure-bred dairy bulls, 48; pure-bred dairy cows, 263; grade dairy cows, 102; demonstrations in the care and management of dairy herds, 6; pure-bred beef bulls introduced, 280; pure-bred beef cows introduced, 960; grade cows introduced for breeding purposes, 600; 59 new beef herds were started through agents' influence; beef-feeding demonstrations conducted, 6; dipping vats constructed by county agents, 129; pure-bred boars introduced, 290; pure-bred sows, 1,053; hog-feeding demonstrations, 98; poultry demonstrations, 4; cattle treated for blackleg and other diseases, 30,979; hogs treated for cholera and other diseases, 200,227; fertilizer demonstrations, 209; silos built under agents' instructions, 88; lime demonstrations, 681; farm buildings erected from plans furnished by agents, 130; number of farmers induced to drain all or part of their farms, 405; home gardens planted under instructions from agents, 7,161.

There was a large increase in the amount of corn, hay, peanuts, rice, and sirup produced for market during the year. There was also a large increase in the number of hogs grown for market. As a result of the introduction by the agents of better breeding animals there was a noticeable improvement in the type of hogs and cattle placed on the market in 1917.

Club work.—All lines of club work are included in one project. The enrollment in the different clubs was as follows: Corn club, 1,132; peanut club, 34; potato club, 5; pig club, 652; calf club, 2; total, 1,825. A limited number of boy scouts were enrolled as emergency members when war was declared.

Inasmuch as the plans for club work already in the hands of club members were directed toward greater food production, there was no reason for radical changes when the campaign for increased food production was started; however, special effort was made to enlarge the scope of the work and to grow and conserve all additional products possible. Club work was organized in 41 counties during the year.

The 1,132 boys enrolled in the corn club made an average yield of 37.67 bushels per acre at an average cost of 46.1 cents per bushel.

Pig clubs.—The pig clubs made unusual progress during 1917 and created more interest among the boys, farmers, and business men throughout the State than any other branch of club work. The swine breeders of Florida have been able to supply about half the pigs needed by pig-club members, and the other members ordered from breeders in southeastern States. The 650 members of the clubs raised pure-bred pigs in 1917 as follows: Duroc-Jerseys, 520; Poland-Chinas, 77; Berkshires, 40; Hampshires, 15. The average daily gain in weight of the pigs was 0.99 pound. The average cost of gain per pound was 6 cents. The bankers of the State loaned money to all boys recommended by the county agent, to be used in purchasing pure-bred pigs. The boys gave their notes for a year and a half at 6 per cent per annum. In nearly all cases the boys are not required to have an indorsement on their notes. The boys have been able to raise pigs and pay the notes when due.

Club work is exercising an important influence, not only on the lives of the boys, but also on the communities in which the members reside. A short course in agriculture was held at the university for prize winners from each county.

Farm and home-makers' clubs.—This work for negroes was carried on in 7 counties of the State having negro county agents. The work was continued on the same plan as in previous years, but it was enlarged in scope to include adult negro farmers as well as boys and girls. Increased production was the most important phase of the work undertaken, but the negro county agents were equipped with canning outfits and gave instructions to the farmers and their wives in canning the waste products of the garden and orchard. Negro farmers were also given instructions on how to control hog cholera and to conserve their meat supply.

There was an enrollment of 1,254 negro boys in the home-makers' clubs, negro agents held 217 farmers' meetings with a total attendance of 8,990. In addition, 7,718 bulletins were distributed and 4,125 official letters written.

Clubs were also organized among negro farmers in 7 additional counties which did not have negro agents. The 23 clubs organized in those counties report 7,840 cans of fruits and vegetables put up during the season. In the negro boys' club work each member selects and cultivates one acre of ground, half of it to corn, one-fourth to peanuts, and one-fourth to sweet potatoes. Systematic records are kept, and the agents collect and tabulate these reports. The plan for the girls is to have one-tenth acre in vegetables. The girls are given instructions in canning, preserving, and housekeeping.

In addition to the work done by the negro county agents, each of the white agents in the State gives assistance to negro farmers.

Home demonstration and girls' club work.—The home-demonstration work was organized in 31 counties. There were enrolled 2,126 girls in canning and garden clubs, 245 in the poultry clubs, 766 in winter garden clubs, and 367 in cooking clubs. The girls in the canning club put up 301,935 tin cans of fruits and vegetables and 115,929 glass jars of fruits and vegetables. The girls in the canning club also put up 26,039 cans and jars of pimento peppers and 36,124 glasses of jelly. The members of the girls' canning club, in addition to the regular work in gardening, canning, and cooking, were given a few lessons in dressmaking.

Home demonstration.—The enrollment of farm women in the home-demonstration work was 1,628. The number of clubs organized was 146. Demonstrations were carried on in gardening, poultry raising, cooking, canning and drying of fruits and vegetables, butter making, and construction of simple devices for convenience in the home. The members of the home-demonstration clubs put up 305,290 containers of fruits and vegetables in glass and tin and dried 50,622 pounds of fruits and vegetables. Ninety-two homes were screened by members of the home-demonstration club through the county agents' influence. Three hundred and ninety useful articles for labor-saving and convenience in the home were installed by members of the home-demonstration clubs, including wheel trays, floor mops, kitchen cabinets, iceless refrigerators, fireless cookers, etc. Seven hundred and ninety-seven home-canning outfits were purchased through the agents' influence. The home-demonstration work resulted in the saving of a large amount of fruits and vegetables that otherwise would have been wasted. One hundred girls in the Girls' Industrial College for Women at Tallahassee, were given instruction in canning and drying of fruits and vegetables during the winter of 1916-17, and these girls did volunteer work without salary after the close of the college session.

Each of the home-demonstration agents voluntarily worked with groups of negro women in counties where there were a large negro population, in giving instructions in canning and drying of fruits and vegetables. As an emergency measure, the county agents were very active in pushing the campaign for poultry raising, home gardening, and substitutes for wheat in bread making. The results in all lines of work have been very gratifying, and efforts of agents met with a hearty response from the women throughout the State.

OTHER PROJECTS.

Hog cholera.—The work under this project was carried on in co-operation with the Bureau of Animal Industry, United States

Department of Agriculture. The bureau sent a veterinary inspector to the State for educational work in connection with hog-cholera control. This inspector worked with county agents in every county in the State and gave numerous demonstrations in hog-cholera vaccination and in disinfecting and cleaning up the premises where there was an outbreak of cholera. Through the work of the specialist and the county agent, the disease has been brought under practical control, and a great impetus given to hog raising in the State.

OUTLOOK.

The county-agent force was increased and strengthened during the year and was liberally supported with funds from both the State and counties. All funds were devoted to putting in a competent man and a woman county agent in each county. More than half the counties of the State now have both a man and a women county agent. The demand for the work is growing each year. The year 1917 has been by far the most successful year in the history of the work in the State. As funds increase a county agent will be placed in every county.

GEORGIA.

Division of Extension, State College of Agriculture, Athens.

J. PHIL CAMPBELL, *Director*.

Organization and administration.—The general plan of organization of extension work in Georgia is the same as outlined in the previous report. One new project was added during the year—that of marketing.

The regular plan for the conducting of field work was modified somewhat during the year. While the principal line of work, as in the past, was conducting field demonstrations, a large part of the time of all extension workers was devoted to stimulating the increased production of food crops as a part of the preparedness program.

Cordial cooperation was maintained between the extension division and other agencies in the State, as in previous years.

Publications.—During the fiscal year ending June 30, 1917, 9 bulletins, 10 circulars, and 10 educational posters were published. A total of 395,000 copies of bulletins and circulars was issued. Newspaper plate service was furnished each week to 150 weekly newspapers of the State. Bulletins were distributed from the director's office to a large mailing list kept for that purpose.

Finances.—The following funds were expended for cooperative extension work in agriculture and home economics for the year ending June 30, 1917:

Smith-Lever, Federal-----	\$56,151.36
Smith-Lever, State-----	46,151.36
United States Department of Agriculture, farmers' cooperative demonstration work-----	53,502.49
United States Department of Agriculture, other bureaus-----	12,640.63
County appropriation-----	85,770.00
State appropriation-----	5,260.15
Other sources-----	1,366.00
Total-----	260,841.99

Smith-Lever funds were used in support of the following projects: Administration, printing and distribution, county agents, home economics, extension schools and farmers' courses, boys' club work, girls' clubs (poultry), field meetings, educational exhibits at fairs, animal husbandry, agronomy, dairy extension, marketing, horticulture, agricultural engineering, and boys' pig clubs. Funds from the United States Department of Agriculture were used in the support of the following projects: Administration, county agents, home economics, boys' clubs, pig clubs, poultry, dairying, and live stock.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—There were employed in county-agent work at the beginning of the year 1916-17, 81 county agents and at the close of the year 111. These 111 county agents were working in 107 counties. Demonstrations with various crops were made with 6,909 farmers during the year 1917. In addition to the regular line of work carried on with crop demonstrations, the agents devoted a large part of their time during the year to the increase of food and feed crops throughout the State. The following is a summary of some of the activities of the county agents during the year: Number of demonstrations with corn, 5,828—average yield 35 bushels per acre; cotton, 3,788—average yield in territory not infested with the weevil 1,100 pounds of seed cotton per acre, in the weevil-infested area 945 pounds; oats, 4,038—average yield, 26 bushels per acre; wheat, 3,735—average yield, 11 bushels per acre; alfalfa, 885—average yield, 2 tons per acre; clover, 1,755; velvet beans, 12,070—average yield, 14½ bushels per acre; soy beans, 725—average yield, 12 bushels per acre; peanuts, 1,650—average yield, 46½ bushels per acre; permanent pastures, 590; hog pastures, 3,180.

Number of dairy cattle brought into the State, 1,535; new herds of dairy cattle started, 60; beef bulls brought into the State, 223;

beef cows brought into the State, 3,901; beef-feeding demonstrations, 80; pure-bred hogs brought in, 4,323; hogs treated for cholera in giving demonstrations, 129,933; cattle treated for blackleg and other diseases, 4,444; silos constructed, 235; dipping vats built, 451; cream routes organized, 42; meat-curing demonstrations, 1,003; poultry demonstrations, 1,353; sheep bought, 300; plans furnished for farm buildings, 699; meat-curing houses built, 74; sweet potato curing houses built, 63; plans for feed mills furnished, 77; waterworks systems installed, 609; lighting plants installed, 206; pruning demonstrations with home orchards, 999; spraying demonstrations with home orchards, 1,677; new home orchards planned, 1,277; home-garden demonstrations, 13,525; drainage and terracing demonstrations, 70; farmers' clubs organized, 323; meetings held in the interest of increased food production and conservation, 223, with a total attendance of 61,500; meetings held for increasing wheat acreage, 270—total attendance, 48,450; circular letters distributed by agents, 123,316; visits made by agents to demonstration farms, 33,899; newspaper articles written, 1,370. The success of the agents in securing increased acreage in food crops was very gratifying. The planting of home gardens was practically State wide. There was an appreciable increase in the acreage planted to corn, 60 per cent increase in wheat acreage, practically 100 per cent increase in the peanut acreage, 50 per cent increase in the velvet-bean acreage.

Boys' club work in crop production.—The members of the boys' club conducted demonstrations with crops as follows: Corn, 6,057; potatoes, 38; cotton, 284; peanuts, 77; farm-makers' clubs among negro boys, 158. The average yield per acre of boys in the corn club was 45.3 bushels, at an average cost of 40 cents per bushel. Fourteen boys in the State reported a yield of more than 100 bushels of corn per acre. In addition to the enrollment of regular club members who conducted demonstrations with corn and other crops there was an emergency enrollment of 3,000 boys who conducted some kind of crop demonstrations.

Pig clubs.—Pig-club work was carried on in cooperation with the Bureau of Animal Industry, United States Department of Agriculture. There were enrolled in the pig clubs during the year, 4,250 boys. Each of these boys secured pure-bred pigs, which were used for breeding purposes. Through the influence of the pig club excellent strains of pure-bred hogs are being placed in every community of the State.

Home demonstration and girls' club work.—At the beginning of the year there were 51 women county agents and at the close of the year 61. There were enrolled during the year 5,171 girls in the canning clubs, 1,231 girls in the poultry clubs, and 6,000 farm women in the home-demonstration work. The members of the girls' canning

clubs put up out of their home gardens 2,139,628 cans and jars of vegetables. They also put up from the home orchards 182,784 cans or jars of fruit. The home-demonstration work for farm women was organized in 56 counties. These women carried on demonstrations in home gardens, poultry raising, practical cookery, and the building and operation of labor-saving devices and home conveniences. The following are some of the results of work with the women and girls during the year: Number of clubs organized, 320; demonstrations given by agents, 5,005; estimated attendance of farm women, 72,736; number of pounds of dried fruit stored, 233,072; number of pounds of dried vegetables stored, 926,950; number of gallons of brined vegetables stored, 53,850; chickens raised in poultry demonstrations, 30,100; number of fireless cookers made, 487; iceless refrigerators made, 316; ironing boards made, 112; wheel trays made, 84; kitchen cabinets, 33; water systems installed, 117; estimated number of women and girls influenced through home-demonstration work, 79,016; estimated number of containers of fruits and vegetables packed by farm women and girls through the influence of home-demonstration agents, 1,462,000.

Poultry clubs.—The poultry-club work was carried on in cooperation with the Bureau of Animal Industry. The specialist in charge carried on the work through the county and home-demonstration agents. The number of girls enrolled in the poultry club was 5,124. Through the poultry-club work better strains of poultry have been introduced in all parts of the State. Plans have been furnished for the erection of poultry houses, and many thousands of farm women have been furnished information on the feeding and care of poultry.

Horticulture.—Three specialists were employed under this project and the work was carried on in 48 counties during the year. Demonstrations were conducted in each of these counties on the pruning and spraying of home orchards and advising the farm women and girls on the best methods of management of the home garden. These specialists took part in 87 meetings, with a total attendance of 10,044. They also assisted in preparing bulletins and circulars on the management of home orchards and gardens.

Agronomy.—Two specialists were employed under this project. Four bulletins were prepared and 81 counties were visited in the interest of general agronomy work; seed-selection demonstrations were given in 23 counties; 97 farmers' meetings were addressed, with a total attendance of 9,473; demonstrations in culture of upland rice were made in 20 counties. The general plan has been to work in cooperation with the county agents and to determine, as far as possible, the agronomy problems of the various sections of the State.

Dairy extension work.—This work was carried on in cooperation with the Dairy Division of the United States Department of Agri-

culture. A leader and two field specialists were employed under this project. The principal work consisted in the introduction of pure-bred animals, assisting in marketing dairy products, encouraging the building of silos, planning dairy barns, and giving instructions in the sanitary handling of milk. The following summary gives some results of the work during the fiscal year: The building of 34 silos, 16 dairy barns, and 10 dairy houses was supervised; feeding demonstrations on 7 farms were conducted; dairymen in 16 counties were assisted in the purchase of better dairy equipment; and 71 pure-bred dairy cattle and 274 grade dairy cows were brought in.

Live stock.—The live-stock extension work is carried on in cooperation with the Bureau of Animal Industry, United States Department of Agriculture. Four specialists were employed in the work. Among the results of the work were: 158 silos built under the direction of the extension specialists, and 863 brood mares, 40 pure-bred stallions, and 60 jacks purchased. In the tick-free area of the State work was carried on in enlarging and improving the beef-cattle industry, with the result that 14,027 registered beef animals were brought into the State during the fiscal year, and 4,595 beef cattle were fed under instructions given by the specialists. Calf clubs have been organized in 60 counties.

There was a large increase during the year in the number and quality of hogs grown in the State under the advice of the extension specialist; 3,886 hogs were purchased for breeding purposes, and 181,870 hogs were fed according to directions in feeding demonstrations conducted by specialists. Greater interest is being taken by the farmers of the State in all kinds of live stock.

Agricultural engineering.—Two specialists were employed to supervise the work of farm engineering. During the year 3,026 plans were made for farm buildings; 2,805 plans and specifications were sent out for potato storage houses; aid was given in the erection of 32 barns, 114 silos, and 17 dipping vats, and in the installation of 7 lighting systems and 11 home waterworks systems; meetings addressed, 35, with a total attendance of 2,107.

Extension schools.—One specialist was employed under this project. Five one-week schools, with a total attendance of 4,250 people, were held by specialists from the college of agriculture during the year. In addition, one-day farmers' meetings were held at 83 places in the State, with a total attendance of 23,000 people.

Educational exhibits.—One specialist was in charge of the work under this project, which consisted mainly in making educational exhibits of farm and garden products by demonstrators and club members at State and county fairs. Three live-stock exhibits were made at the district fairs, and it is estimated that 100,000 people visited

these three exhibits. Exhibits were also made at the State fair at Macon and the Southeastern fair at Atlanta. It is estimated that 200,000 people visited the exhibits at these fairs.

Marketing.—This work is carried on in cooperation with the Bureau of Markets. One specialist was employed. A market news service gave market news reports each day during the marketing season to 2,000 fruit and truck growers.

Demonstrations were given in the grading and packing of truck products. Work was begun in a small way in a few of the counties in the southern part of the State in organizing marketing clubs for cooperative selling of hogs. This work met with favor by the farmers and is to be extended.

OUTLOOK.

All lines of extension work are receiving a hearty welcome in all sections of the State. The number of county agents greatly increased during the year. An organization was perfected in each county for securing the support of public-spirited citizens, both business men and farmers, in the campaign for a larger production of food crops. A large increase in the production of corn, potatoes, peas, beans, vegetables, canned and dried fruits resulted during the year from the work of extension agents. The outlook is good for an exceptionally effective year's work along all lines of extension activities.

KENTUCKY.

Division of Extension, College of Agriculture, University of Kentucky,
Lexington.

FRED MUTCHLER, *Director*.

Organization and administration.—No changes in the organization occurred during the fiscal year 1916-17 that in any way affected the work. The director of extension has general supervision of all extension work, and reports to the dean of the college of agriculture of the State university. The organization, as it now exists, consists of a director, assistant director, State agent in charge of men's work and State agent in charge of women's work, 4 district agents in men's work and 3 district agents for women's work, 46 county agents for men's work and 28 agents for women's work, 6 full-time specialists and 3 part-time specialists. This was an increase during the year of 4 men county agents, 3 women county agents, 2 full-time specialists, 2 district agents in men's work, and one district agent for women's work. A new project providing for work in markets was added during the latter part of the fiscal year.

The relations with all organizations in the State carrying on related lines of work were cordial. The relations with the State department of agriculture and the State department of education were all that could be desired. There are many voluntary agricultural organizations in the State, and the extension division has utilized these to good advantage in carrying out its program. The two normal schools of the State continue to provide office space and financial support to employees of the extension division. Liberal support, both moral and financial, has been furnished by such organizations as commercial clubs, farmers' clubs, business men's leagues, bankers' associations, and the like.

The extension division is well housed in the experiment station building of the college of agriculture. Facilities for the distribution of literature, the handling of lantern slides, charts, and the like are being increased from year to year.

Publications.—Publications issued during the year included 7 circulars, totaling 201 pages and 51,000 copies; 10 lessons on soils for boys' club members, totaling 40 pages and 50,000 copies; 24 semi-monthly farm bulletins with 6,000 copies per issue; and large, illustrated posters with a monthly issue of 600 copies. Literature is distributed through a mailing list consisting of the names of all agents, newspapers, interested farmers, and public officers.

Finances.—The following funds were expended for cooperative extension work in agriculture and home economics for the year ending June 30, 1917:

Federal Smith-Lever.....	\$43, 731. 15
State Smith-Lever.....	33, 731. 15
United States Department of Agriculture, Farmers' Co- operative Demonstration Work.....	34, 605. 71
United States Department of Agriculture, other bureaus.....	3, 308. 63
County appropriations.....	33, 000. 00
Other sources.....	7, 000. 00
State fund.....	2, 546. 12
Total	157, 922. 76

The Smith-Lever funds were used in support of the following projects: Administration, printing and distribution of publications, county agents' work, home economics, home-economics specialists, movable schools, boys' club work, pig-club work, poultry-club work, poultry specialist, horticulture, live stock, dairying, agronomy, veterinary science, marketing, and negro work. Funds from the United States Department of Agriculture were used for the following projects: Administration, county-agents' work, home economics, boys' club work, poultry clubs, pig clubs, marketing and rural organization,

and negro work. A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—The work under this project made reasonable gains over the previous years. During the year 46 agents were working in that number of counties. After the entrance of the country into war in April, the county agents were put to a severe test in that they were called upon to do many kinds of emergency work in addition to their regular duties. The county agents have made every effort to hold to their regular lines of work as well as to meet the emergency problems that have arisen. The good spirit with which they responded to these diverse calls can not be commended too highly.

There were during the year 40 county agricultural boards of control with a membership of 695, and 285 community farmers' clubs with a membership of 10,266. These organizations have been of inestimable value in carrying out emergency programs.

The county agents spent 83 per cent of their time in the field and 17 per cent in the office and in miscellaneous work. The following is a partial summary of their activities: Number of visits to demonstrators, cooperators, other farmers, business men, and boys' and girls' club members, 31,354; miles traveled, 184,992; calls on agents at the office or home, 47,756; farmers' meetings held, 2,918, with a total attendance of 203,129; field meetings held, 457, with a total attendance of 5,920; official letters written, 20,751; articles prepared for publication, 951; United States Department of Agriculture bulletins distributed, 38,188; State bulletins distributed, 34,235; visits to schools, 1,128; courses in agriculture for schools outlined, 122; demonstration home orchards, 319, containing 44,760 trees. The agents gave assistance in spraying, pruning, etc., 3,122 orchards, containing 363,992 trees; advised 19,892 farmers with reference to the use of fertilizers; conducted 1,927 demonstrations with fertilizers; assisted 75 communities in cooperative buying, with a total value of \$143,568.62 and with a saving of \$28,661.27; assisted in building 831 silos; influenced 2,829 farmers to use lime, with a total of 26,515 tons; assisted in building 240 houses and improving 395; furnished plans for 151 houses; installed 48 home water systems and 17 lighting systems; screened 746 houses; installed 228 flytraps; and erected 51 sanitary privies. Two hundred and fifty farmers were induced to adopt systematic crop rotation; 84 to remove stumps from land; and 5,144 to plant winter cover crops. Three hundred and eighty-eight permanent pastures were established, 93 drainage systems put in, and 10,202 home gardens were planned or improved. The following

table gives the results of work carried on by the agents with field crops:

Some results of field-crop demonstrations in Kentucky, 1917.

Crop.	Demonstrators.				Cooperators. ¹			Total.	
	Total number.	Reporting.	Acreage.	Average yield per acre.	Number.	Acreage.	Average yield per acre.	Demonstrations.	Acreage.
Corn.....	954	526	18,289	² 47	1,754	25,428	² 32	2,708	43,717
Cotton.....	20	17	473	² 875	47	423	² 675	67	896
Tobacco.....	357	210	2,311	³ 1,240	.....	(¹)	.....	357	2,311
Wheat.....	498	318	9,175	14.2	673	6,519	³ 11	1,171	15,694
Oats.....	140	92	1,478	40.5	351	4,052	² 37	491	5,530
Rye.....	284	208	5,519	² 17	191	1,616	² 11	475	7,135
Barley.....	75	31	502	² 22	6	545	² 13.5	81	1,047
Alfalfa.....	501	326	3,117	⁴ 4	35	179	⁴ 2.3	536	3,296
Red clover.....	627	410	8,148	⁴ 1.5	596	7,702	⁴ 1.75	1,223	15,850
Sweet clover.....	852	438	4,175	⁴ 2.5	278	1,497	.....	1,130	5,670
Crimson clover.....	377	127	3,677	⁴ 2.5	894	3,609	.....	1,271	7,286
Cowpeas.....	418	254	3,513	⁴ 3	793	4,852	⁴ 1.5	1,211	8,365
Soy beans.....	959	529	6,030	² 14 ⁴ 2.5	494	4,038	² 8.25 ⁴ 2	1,453	10,068
Potatoes.....	435	243	3,960	131	.....	.....	.....	435	3,960
Total.....	6,497	3,759	70,387	.....	6,112	60,458	.....	12,609	130,825

¹ A cooperator conducts a demonstration, but his farm is not visited regularly by the agent.

² Bushels.

³ Pounds.

⁴ Tons of hay.

The interest in live-stock improvement has continued in the State this year. Through the activities of the county agents 72 pure-bred horses were brought into the State this year; 1,698 dairy cattle, 531 of which were pure bred; 490 pure-bred beef cattle, and 441 grades; 1,086 pure-bred hogs; 367 pure-bred sheep, and 4,205 grades. There were 1,464 poultry demonstrations, with 20,701 fowls; 18 feeding demonstrations with horses and mules; 78 feeding demonstrations with 2,396 cattle; 481 feeding demonstrations with 8,242 hogs; and 3 feeding demonstrations with 48 sheep. Beef-cattle herds were started on 89 farms, hograising on 731 farms, and sheep on 187 farms. Farmers were induced to treat for various diseases and pests 18,900 cattle; 90,565 hogs; 2,643 sheep; and 323 horses.

Boys' club work.—The boys' club work was in charge of a State club agent, assisted by a special agent in animal husbandry. The field work was carried on by these agents through county agents in cooperation with the school authorities in the various counties. The following is a tabulated report of the work under the boys' club project for the fiscal year:

Results of boys' club work in Kentucky in 1917.

Crop.	Total number enrolled.	Total number reporting.	Average yield of crops.	Cost per bushel	Total value of product.
Potatoes.....	201	79	1 199.63	\$0.32	\$7,884.20
Tomatoes.....	32	18	252	.13	2,440.00
Tobacco.....	113	31	2 4,353	.031½	13,051.00
Soy beans.....	66	29	21	1.83	1,827.00
Alfalfa.....	11				100.00
Corn.....	751	252	57.61	.38	21,605.00
Peanuts.....	5				
Total.....	1,179	409			46,908.20

¹ Bushels.

² Pounds.

Pig clubs.—This work is carried on in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture. Specialists in charge assist the county agents in organizing clubs, holding meetings, securing registered pigs, visiting club members, and instructing them along proper lines of swine husbandry. County agents follow up the work by visiting the members, weighing their pigs, checking up their records, giving instructions and holding meetings. One thousand and sixty-eight members were enrolled in the pig clubs, and 438 made complete reports, showing an average cost per 100 pounds gain of \$9.26 and a total value of \$22,588.16. Bankers, business men, and farmers have manifested a lively interest in this phase of the work and have supported it liberally both morally and financially. No phase of the county-agent's work has brought him into great favor with the farmers and business men of his county. Many farmers have changed their methods of feeding as a result of the pig-club work, and it has been instrumental in introducing into many counties pure-bred live stock on a rather extensive scale.

Home demonstration and girls' club work.—There were employed under this project a State agent, 3 district agents, and 28 county agents. The number of girls enrolled in canning clubs was 3,313, 1,734 of whom reported. One hundred and eighty girls were enrolled in poultry clubs. The number of girls making demonstrations in cooking clubs was 393; the number carrying on bread demonstrations 130; total number of filled fruit and vegetable containers from one-tenth acre plats, 505,836; total number of jars of products from farm and orchard, 1,246,374; total value of all products, \$388,412.60.

In the home-demonstration branch of the work 469 clubs were organized with an enrolled membership of 12,000. The women making demonstrations in cooking numbered 8,000; in bread making, 654; number of fireless cookers made, 189; iceless refrigerators, 39; flytraps, 385; kitchen cabinets, 47; ironing boards, 39; driers, 1,800; water systems installed, 12; houses screened, 500; containers of fruits and vegetables packed, 1,803,807; pounds of dried fruit and

vegetables stored, 306,967; and gallons of brined vegetables stored, 77,163. The total value of canned products was \$360,779.40. The figures for the year, showing as they do a large increase over the results of last year, were evidently the result of the wonderful response of the women of Kentucky to the patriotic appeal made to them by the home-demonstration agents and others. More food products were stored in Kentucky during the year than for a number of previous years combined.

Boys' and girls' poultry clubs.—This work is carried on in co-operation with the Bureau of Animal Industry of the United States Department of Agriculture. The poultry project is closely related both to boys' work and canning-club work. The object is to educate the boys and girls of the farm in better poultry products. One thousand four hundred and forty-four boys and girls were enrolled in poultry-club work, 854 reporting. An effort was made to standardize the poultry in a number of counties with the result that 103,388 hatching eggs from five varieties were distributed. The work was organized in 18 counties of the State. Through the effort to standardize the poultry, through boys' and girls' poultry work, widespread interest and better poultry husbandry, especially as to housing and feeding methods, have resulted.

Home-economics specialists.—Oral instruction, by means of addresses, conferences, and round-table discussions, through farmers' clubs, parent-teachers' associations, commercial clubs, boys' and girls' high schools, and demonstrations at requests of county agents, was given to 12,275 persons. Home-demonstration work in cooking was conducted through rural schools of Mason County with 140 girls participating. Demonstrations were carried on under written directions of the specialist in home economics in each girl's home. The same type of work was introduced in eight schools of Scott County. Seven thousand four hundred and seventy-six mimeographed directions and suggestions regarding clothing budgets, household efficiency tests, charts for color selection and dresses, cost of materials for clothing the family, fireless cookers, family budgets, emergency recipes, food substitutes and food values, have been sent to interested persons throughout the State. One thousand, seven hundred and forty-three extension letters were written to persons requesting specific information along the line of this project. One hundred and forty homes were reached through this work. The specialist's time was in great demand by various women's organizations of the State interested in war emergency work. The specialist has at all times cooperated with, and work through, the women county agents and, in counties where no women agents are found, with the men agents.

Poultry.—One specialist was employed under the poultry project. The outstanding feature of poultry work for the year was the standardization plan carried out by the poultry specialist. The idea of standardizing the breed of fowls in the county has far-reaching effects, since it effects the elimination of scrub fowls on the farm, replacing them with pure-bred poultry. Farmers take better care of pure-bred poultry, feed better rations, and build better houses: the result is greater profit. The work of the specialist has been carried on through the county agents in 20 counties. Other lines of work, such as feeding and incubation demonstrations and the building of poultry houses, were carried on by the specialist. During the year 370 farmers were induced to produce infertile eggs. One hundred and three thousand three hundred and thirty-eight eggs of pure-bred varieties of poultry were introduced in 20 counties; 1,464 demonstrations were carried on; 2,122 farms were reached in the matter of improved poultry management, and 10 new egg circles were formed.

Agronomy.—The specialist for this project was appointed acting dean of the college of agriculture about September 1, 1916, and his activities as agronomy specialist were greatly limited thereby. During the year the specialist made 26 addresses at meetings, visited 3 county agents, aided 1 county agent in planning a number of demonstrations in the use of limestone and phosphate, and attended 6 important conferences on food production.

Live stock.—The live-stock specialist assisted the county agents in perfecting their demonstrations in animal husbandry. His activities included organizing community breeding associations, assisting county agents in various kinds of meetings where live-stock subjects were to be discussed, answering by correspondence the requests of farmers and agents regarding live-stock matters, and assisting in the selection of breeding stock for individuals and associations. Seventy-one horses and mules, 200 sheep, 2,250 cattle, and 1,400 swine, most of them registered, were brought into the counties during the year under the direction of the specialist for breeding purposes. Through the cooperation of the county agents the live-stock specialist conducts an exchange for the benefit of farmers desiring to locate breeding stock. The demands made upon this service increase from year to year. Two hundred and fifty farms are following instructions given by the specialist and some 9,000 people have been instructed by him through the various channels at his command during the year. The specialist prepared two pamphlets for publication and contributed numerous articles for periodicals.

Dairying.—The dairy specialist conducted work along four general lines: (1) Cooperation among dairy farmers with special reference to improving market conditions in the industry; (2) the pro-

motion of greater efficiency in production by bringing to the attention of dairy farmers correct principles of organization and management; (3) work at farmers' chautauquas, farmers' clubs, and special meetings; and (4) the extension of dairy farming and silo building. During the year a complete survey was made of 200 dairy farms. The results of this survey work were tabulated and gave for the first time reliable figures for the State in dairy farm organization and management. During the year 200 farms have adopted the instructions of the dairy specialist; 40 farms have carried on demonstrations in the work; and 10,000 people have been reached through demonstrations, meetings, etc. The specialist has aided in preparing dairy exhibits for farmers' week at the college of agriculture and for the Kentucky State fair; has assisted in judging dairy cattle and dairy products; has aided farmers in selecting and purchasing breeding stock for dairy purposes; has prepared 9 plans and specifications for dairy farms; supervised the erection of 13 silos; and has furnished plans and information for the construction of 100 silos.

Marketing.—Extension work in marketing and rural organization, in cooperation with the Bureau of Markets of the United States Department of Agriculture, was projected during the year under the leadership of a specialist with three part-time specialists. The work is carried on in connection with county agents and available agencies and organizations. Advice and assistance were given for the development and improvement of community organizations and cooperative-marketing organizations, with special reference to the standardizing of grading, packing, assembling, and storing of the products of the farm. Lists of dealers, manufacturers, and storage plants for farm produce have been prepared and sent out upon the request of those desiring such information. These have been especially helpful to county agents. Under the direction of the marketing specialist 18 counties held cooperative wool sales, including 1,006 farmers with an ownership of 30,129 sheep. In the 25 counties reporting not holding cooperative sales there was an average price of 52½ cents per pound for wool, while 58 cents per pound was the average price in counties where cooperative sales were held. A buckwheat-growers' association was started in Pulaski County. A Kentucky pure-bred live-stock association was organized at the instance of the specialist. During the year some 3,500 people were reached through the marketing specialist. One of the most important accomplishments of the year was the establishment of friendly relations between the milk producers in the vicinity of Cincinnati and the dealers of that city. Through the marketing division a committee on arbitration was appointed that adjusts all differences between producers and dealers.

Horticulture.—The specialist in horticulture has been working with 11 organizations and has succeeded in forming two new organizations in the interest of horticulture—namely, the Madison County Cantaloup Growers' Association and the Laurel County Potato Growers' Association. Both of these made very satisfactory records for the first season. The four well-organized strawberry associations of the State closed a very prosperous season. The orchard work has consisted of better methods of cultivation, pruning and spraying demonstrations, and instructions in picking, packing, and storing fruits. The work with vegetables consisted of better cultural methods, better seeds, and the utilization of vegetables. The number of farms adopting the instructions of the demonstration agent were 55 in potato seed selection and 165 in pruning and spraying. The specialist worked through 4 strawberry growers' associations, 2 truck growers' associations, 2 potato growers' associations, and 1 cantaloup growers' association, with a total membership of 1,000 farmers. One hundred and eighty-two orchard and garden demonstrations were conducted under the direction of the specialist. The specialist held 124 meetings, addressing a total of 9,745 people. Recommendations were made for planting 61 new orchards, and 116 new spraying outfits were purchased in the State. The specialist reached, in all, 31 counties through the county agents.

Veterinary science.—The most important work carried on by the specialist was an organized effort to control hog cholera. This was supplemented by an effort to control blackleg. The specialist worked through the county agents, teaching by demonstrations better sanitation and the use of hog-cholera serum and blackleg vaccine. The specialist has at all times cooperated with the Kentucky Livestock Sanitation Board and the Bureau of Animal Industry of the United States Department of Agriculture. During the year he made 109 demonstrations, addressed 142 meetings, with an attendance of 8,313, and vaccinated 503 hogs demonstrating the use of antihog-cholera serum.

Negro work.—This was the first year of negro work separate from the regular work, and only one man was employed under this project. He devoted most of his time to Madison County, in which there is a rather large colored population. The results of his efforts were so satisfactory that the work with negroes is to be extended in the new year. The work of this agent consisted largely in pressing the campaign for increased production and the employment of better methods in seedbed preparation and crop cultivation. He was instrumental in having eight sanitary outhouses constructed, and a large number of homes whitewashed. During the summer he devoted considerable time and effort to inducing negro women to conserve their fruits

and vegetables. The negro people in the city of Richmond alone put up 1,200 cans of vegetables besides drying large amounts.

OUTLOOK.

All the records indicate that the regular work for the fiscal year 1916-17 was kept well up to the standard, regardless of the fact that all the forces in the State were called upon to render a great deal of service in the various emergency campaigns. The entire extension force assisted in the special campaigns for production and conservation, as well as the Liberty Loan, Red Cross, and like campaigns. While these special calls were rather confusing to the workers in the beginning, they are rapidly learning to adjust themselves to them, and the outlook for the year, in view of the increased force resulting from the emergency appropriation, is very promising.

LOUISIANA.

Extension Division, College of Agriculture, Louisiana State University,
Baton Rouge.

W. R. DOBSON, *Director*; W. R. PERKINS, *Director*, July 1, 1917.

Organization and administration.—The extension activities in Louisiana were continued under the same general plans as outlined in previous reports. In March, 1917, Mason Snowden, the State agent, died and was succeeded by W. R. Perkins. At the end of the fiscal year Prof. Perkins was made director and State agent, Prof. Dodson resigning as director of extension to devote his entire time to his work as director of the experiment station and dean of agriculture for the college. Miss Alice Keeler, State agent in women's work, resigned in April and was succeeded by Miss Alice Hickman. The specialist in corn clubs and the poultry specialist also resigned. The usual number of changes occurred in the county agents' force. The organization at the close of the fiscal year consisted of the director, State agent, assistant in charge of junior extension work, State agent in women's and girls' work, 3 district agents and 2 women district agents, 42 men agents and 20 women agents, 7 negro men agents and 1 negro woman agent, and 14 full-time and 1 part-time specialist. This is an increase of 8 workers over the number employed the previous year.

All lines of the work have made satisfactory progress during the year. The agents and specialists spent a large part of their time in pushing emergency work, made necessary to meet war conditions. Notwithstanding the fact that so much of the time of the extension workers was devoted to these unusual and additional features, the regular demonstration plans that had been mapped out previous to the declaration of war were not seriously upset.

Pleasant cooperative and working relations continued with the State department of agriculture, State department of education, parish school boards, police juries, chambers of commerce, bankers' and business men's associations, railroads, the State press, the State sanitary board, etc.

Farmers' institute work is still under the supervision of the director of extension and is now carried on by means of extension schools, in which members of the faculty from the college, the experiment station, and the supervisory and specialist force of the extension division took part. The State department of agriculture also furnished some speakers for these extension schools. The cooperative relations with the Southern University were continued, and two negro agents have been added to the force since the last report.

Housing accommodations for the extension force are provided by the State university and are sufficient for present needs.

Publications.—Six circulars were published during the year, with 116 pages and a total issue of 52,500 copies. These publications related strictly to extension work. The material was gathered and prepared by the specialists in the extension division or by members of the agricultural faculty of the college and experiment station and was written in a practical and simple style for general distribution among the farmers. The publications are sent in bulk to county agents and by them distributed to the individual farmers. A miscellaneous list is kept in the director's office, to which all publications from the experiment station or the extension division are sent as published. A large number of circular letters regarding special lines of work were sent out by the leaders during the year. The extension editor furnishes publicity articles to the papers, edits the circulars and press bulletin, a weekly publication issued by the extension division.

Finances.—Extension projects for 1916-17 were supported from the following sources:

Federal Smith-Lever	\$35,853.87
State Smith-Lever	25,853.87
United States Department of Agriculture, farmers' cooperative demonstration work	37,809.93
United States Department of Agriculture, other bureaus	6,621.23
County appropriation	35,621.74
College appropriation	400.00
Other sources	860.00
Total	143,020.64

Smith-Lever funds were used for work under the following projects: Administration, county agents, home demonstration, girls' clubs, boys' clubs, printing, growing and shipping truck, poultry,

clubs, marketing, negro work, corn production and improvement, and travel of experts, home-study clubs. Funds of the United States Department of Agriculture were used on all of these except printing, horticulture, and travel of experts.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—The county-agent work continues to grow in popularity in the State, and is rapidly becoming recognized as the established method of distributing agricultural information among all the people of the State. The extraordinary conditions that have prevailed throughout the country during the year have added very much to the duties of the county agents, and they have been called upon to do a great many things which under ordinary circumstances would not be considered strictly in their line of work. They have performed these additional duties with credit to themselves and at the same time have continued to carry out the plans of work which were outlined at the beginning of the year.

As a result of the campaign for food production it is estimated that Louisiana increased the total acreage in all food crops 10 per cent, but owing to unusual drought the yields per acre were materially decreased. The community organization work of the county agent has been continued and was found to aid him very much in meeting the urgent demands made upon his services.

Serious outbreaks of hog cholera and charbon again occurred, and the agents continued to treat animals in some localities when called upon by the farmers, but in most cases farmers have been taught how to treat animals, thus relieving the agents to a great extent of this work. Agents have continued to render effective assistance in the campaign for tick eradication, and they have been very helpful also in treating crops for insect and plant diseases.

The following are a few of the most striking results obtained on the demonstration farms and through the influence of the parish county agents in cooperation with the specialists: One thousand five hundred and ninety-six corn demonstrations, totaling 38,875 acres, an average yield, 29 bushels; 876 cotton demonstrations, 20,515 acres, yielding 986 pounds of seed cotton per acre; 678 oat demonstrations, acreage, 11,380, yielding 42.6 bushels per acre. There were a number of demonstrations in other small-grain crops, which, in most cases, were fairly successful. There were 183 demonstrations in lespedeza, 30 in crimson clover, 27 in red clover, 14 in oats and vetch, 89 in alfalfa, 973 in cowpeas, 688 in velvet beans, total acreage in the last two crops, 41,485, grown mostly in corn and on land

from which small grain had been grown. A special velvet-bean campaign was made, which resulted in the planting of more than 100,000 acres in the State. One hundred and nine demonstrations in soy beans were held, 141 in peanuts, 194 in Irish potatoes, 665 in sweet potatoes. There were 150 orchard demonstrations, comprising 30,069 trees and 869 orchards, with 154,025 trees, were inspected and assistance given in pruning and spraying. The agents succeeded in bringing into the State 651 pure-bred horses, 1,818 dairy cattle, 23,720 beef cattle, 1,780 hogs, 160 head of goats, and 985 sheep. Three hundred dipping vats were constructed; 60 poultry demonstrations were held, with more than 6,000 birds; 5,190 cattle were treated for blackleg, 102,874 for charbon; 49,000 hogs for cholera; 5,065 farmers were instructed in the use of fertilizer, of which 1,297 tons were bought cooperatively, with a total saving of \$3,360; and 148 farmers used lime. One hundred and seventy-nine new silos were built, making a total of 704 in the State; 272 new farm buildings were erected, 428 remodeled, 77 plans furnished, 552 buildings whitewashed, 87 home waterworks systems installed; 130 lighting systems, 1,621 home grounds improved, 8,676 houses screened, 1,379 pastures started, 1,363 farmers started drainage systems, 330 farmers removed stumps, 2,931 terraced land, 8,730 planted home gardens; 72,802 farmers saved some farm products for winter use; 807 planted 20,887 acres of cover crops to turn under.

New implements bought: Seventy-four binders, 181 mowers, 116 rakes, 139 hay presses, 84 grain drills, 292 ensilage cutters, 282 gas engines, 30 disk harrows, 326 cream separators, 505 two-horse cultivators, and 3,000 small tools and implements.

Community clubs organized numbered 148, with 3,411 members, and 66,960 visits were made by agents. The agents traveled 198,314 miles and had 23,236 personal calls for information, held 1,965 farmers' meetings, with a total attendance of 117,210; held 752 field meetings, with an attendance of 7,572; wrote 21,151 official letters, prepared 1,230 articles; sent out 30,311 circular letters; distributed 41,767 department bulletins and 22,855 college bulletins; visited 2,614 schools in the interest of club work; held 87 extension schools, with a total attendance of 10,607. Seven hundred and thirty farmers attended the short course at the college, 308 boys and 137 girls attended a summer short course; 1,650 demonstrators, club members, and farmers made exhibits at the fair; 356 farmers kept crop records; 2,685 selected seed; 3,079 demonstrators are reported as raising all of their home supplies.

Negro work.—The Southern University, which is the negro agricultural school for the State, cooperates in the negro demonstration work. The president serves as district agent for negroes, and reports

to the State agent. At the close of the year there were seven local agents. Judging from the reports received, all are rendering good service. A negro farmers' conference was held at the Southern University at the same time that the short course was held for the white farmers at the Louisiana State University. The local agents took part in the conference, and explained to the people assembled the work they are trying to do for their people. It is believed that this meeting was very beneficial in opening up the way to get the negro work better organized in those sections where it has not yet been placed.

Boys' club work.—All county agents are required to assist in the boys' club work, and from 15 to 25 per cent of their time is devoted to it. This work was organized in 44 parishes and is under the general supervision of the superintendent of the extension club work. The field work is done largely by the club specialist and the county agents. A short course for boys and girls was held at the college, at which they were instructed by the specialists and other picked speakers in the lines of club activities which are being carried on. Part of the time was devoted to regular classroom work and the remainder of the day to practical demonstrations and sight-seeing. The members of the corn clubs exhibited their products at the parish and State fairs and won a number of prizes at each. There were enrolled in the club work during the year 7,400, classified as follows: Corn clubs, 2,400; potatoes, 100; cotton, 200; calf, 153; pig, 3,645; poultry, 1,000; and farm-makers' clubs for negro boys, 3,000; making a grand total of 10,400. The average yield of the boys reporting in corn clubs was 29.8 bushels per acre, at an average cost of 32 cents a bushel.

Home demonstration and girls' club work.—A State agent, an assistant State agent, a district agent, a home-demonstration specialist, and 20 parish¹ agents were engaged in this work during the year. All of the regular women parish agents are now employed for 12 months in the year, and no one receives less than \$100 a month.

Two agents' meetings were held during the year, which were of great value in training the women to plan and carry out the work. The local funds supporting the home-demonstration work in Louisiana are supplied usually by the parish school board, and this, of course, insures the hearty support and cooperation of the school officials and teachers. Parish and community fairs were held in every parish where the work had been established. Food conservation was advocated and pushed in every way possible.

¹ In Louisiana this civil division corresponds to the county in other States.

At the Shreveport fair the girls' canning-club members made fine exhibits. These exhibits were sent to the New Orleans National Farm and Live Stock Show, where they attracted considerable attention.

In the canning-club work 31 counties were organized, and 1,026 girls enrolled; 386 were enrolled in poultry clubs; 2,835 in winter gardens; 272 made cooking demonstrations; 86 made bread demonstrations. Forty-five scholarships were awarded as premiums by the counties, and 15 by the State.

Cans of vegetables put up, 66,260; jars of vegetables, 30,138; jars of fruit, 30,592; of pepper products, 523; fruit juice, 280; glasses of jelly, 990. Total number of containers put up from the one-tenth acre plats, 96,898, valued at \$22,884.50; farm products put up, 51,352 containers, valued at \$17,973.20, making a total value of all products of \$40,857.70.

Caps and aprons made numbered 448; dresses, 110; towels, 574; towel holders, 429.

The home-demonstration work made satisfactory progress during the year. There were enrolled 1,510 women; in the poultry-club work 135. Fifty-four clubs were organized. Bread demonstrations were carried on by 275 women; 40 fireless cookers, 24 iceless refrigerators, 49 kitchen cabinets, and 19 ironing boards were made; 1,278 winter gardens were planted; 1 egg circle was organized; 5,832 pounds of vegetables and fruits were dried, and 1,567 gallons brined. A total of 235,336 containers were put up, valued at \$28,642.90.

Home-makers' clubs.—Home-makers' club agents were employed during the year in two parishes to instruct the negro women and girls in the canning and handling of surplus fruits, and in sanitation and the management of household affairs. The reports from these agents indicate that they accomplished a good deal along these lines. At their suggestion many schoolhouses were painted or whitewashed, and general conditions improved. The home-makers' clubs made creditable exhibits at the State fair.

Poultry clubs.—The specialist in this project is employed in cooperation with the Bureau of Animal Industry. His duties are to cooperate with the other extension forces in establishing poultry clubs, to give general information in the growing and handling of poultry, and to assist in the developing of plans for better marketing of the products. The work is done largely through the high schools and home-demonstration agents. During the year 75 clubs, with a total membership of 740 were organized in 30 parishes. Of the 52 agricultural high schools in the State last year, 43 had poultry clubs. The use of only pure-bred birds has been encouraged by the poultry breeders selling eggs to club members at reduced prices. The mem-

bers of the poultry clubs exhibited at the parish and State fairs and made an excellent showing.

Corn production and improvement.—The specialist in charge of this work devoted his entire time to the improvement of corn, and assisted in the organization of the corn clubs, in getting out information for the use of the farmers and club members in regard to the best methods of preparing land for corn, cultivation of the crop, selecting of seed, and anything else that might be considered of value for increasing the acreage production of corn in Louisiana.

Horticulture.—The horticulturist of the experiment station devoted half of his time to extension work under this project, and was assisted by two full-time specialists—one for truck crops and one for pecan culture.

Truck-crop demonstrations were confined mostly to growing and marketing winter Snowball cauliflower and Brussels sprouts, and to developing a type of bean seed free from pod-spot disease. The specialists assisted many truck growers in classifying, packing, and preparing their products for market. This has resulted in their receiving better prices, and better marketing facilities. The severe freeze in the middle of November, 1916, killed a great many of the cauliflower and Brussels sprouts, but enough came through to demonstrate that under normal conditions this was a profitable line of truck growing for southern Louisiana.

The pecan work was confined chiefly to demonstrations in budding and grafting upon seedling trees the leading commercial varieties. A survey of the State was made to locate seedling pecans of exceptional merit.

Twenty-six mimeographed circulars were issued to supplement demonstration work and meet the general demand for information on home vegetable gardens. A four-year course in gardening for the home-demonstration work was prepared. There were 18 demonstrations with cauliflower in 6 parishes; 10 with Brussels sprouts in 4 parishes; 7 with beans in 2 parishes; 10 in shipping peppers and egg-plants by carload lots; and 71 in budding and grafting pecans in 17 parishes, with an attendance of 391.

Marketing.—This work is cooperative between the Office of Markets and Rural Organization and the extension division. The leader was very helpful in working up an interest in the curing of meats for home use at local ice plants. Three demonstrations in curing pork products were conducted, and direct advice relative to home curing of meats was given to more than 100 persons. Cooperative shipping of live stock by farmers was started in 12 parishes and arrangements for cooperative shipping were made for 12 more parishes. Aid was given in grading and shipping 23 carloads of cattle, sheep, and hogs. Arrangements were made for reorganizing the

live-stock market at New Orleans and for the erection of a packing plant in that city. Valuable assistance was also given to the wool growers in the selling of more than 200,000 pounds of wool.

EXTENSION WORK OUTSIDE OF SMITH-LEVER PROJECTS.

An important line of extension work in Louisiana in cooperation with the county agents, not financed by the Smith-Lever funds, is the live stock extension work for the sugar-cane and cotton-growing districts. This work is under a superintendent, who is responsible to a committee composed of the Chief of the Bureau of Plant Industry, Chief of the Dairy Division, and director of the State experiment station and extension work in Louisiana. The latter, being located in the State, has been charged with the detail work of supervision. The swine husbandman, the beef-cattle specialist, the forage-crop specialist, and the market specialist all resigned during the year and were replaced by other men.

Live-stock demonstration.—The specialists for beef cattle, swine, and poultry work have established definite demonstrations in cooperation with county agents in various sections of the State. There were 28 demonstrations with beef cattle, 32 with swine, and 28 with poultry. The progress of these demonstrations has been generally satisfactory, and they are now showing beneficial effects in practically every community where they were located.

Dairy extension.—The dairy project was assigned two men whose principal work was to furnish information on dairying problems to the county agents and farmers generally. Valuable aid was given the dairymen in and about the towns and cities. The creameries established were advised by the specialist regarding the handling of the herd and the products. Information was furnished by letters, circulars, and in addresses on selection of cows, preparation of pastures, feeding of a balanced ration, caring for the calves, building barns, silos, etc.

Forage-crop work.—The forage-crop agent, counting previous work, cooperated closely with the beef-cattle and swine specialists, attending to the question of pasture and forage crops for their demonstrators; in addition, he rendered assistance to demonstration agents and other agricultural workers on the question of forage crops in general. The points particularly stressed were the more economical use of winter grazing crops, the finishing of hogs and cattle on legumes planted with corn, and the increased acreage of clovers, lespedeza, Bermuda and native grasses. He delivered lectures at short courses and also assisted in judging at fairs and in the food preparedness campaign.

OUTLOOK.

The extension work is now recognized as the greatest factor in the development of the agricultural resources of the State. The efficiency of the organization has been thoroughly tested during the year. Notwithstanding that the emergency call for food crop increase came after a large part of the crops was planted, much was accomplished by better culture, planting of more catch crops, and in the conservation work. Every member of the extension force seems to appreciate the opportunity for service. The personnel shows up well. The agents are young, alert, capable, and enthusiastic. Any increase of funds will be utilized in strengthening and expanding the lines of work already started. Salaries are too small to attract or hold indefinitely the class of agents that is required to attain the maximum results.

As a whole the future seems to be promising.

MARYLAND.

Division of Extension, Maryland State College, *College Park*.

THOMAS B. SYMONS, *Director*.

Organization and administration.—There were no marked changes in the organization during the year, but a number of changes in the personnel, including the resignation of the State agent and a number of specialists. The position of State agent was abolished and there was created instead the position of assistant director, who performs the function of State agent as well as acting director in the absence of the director.

The relations of the extension division and the other departments of the college were cordial and cooperative. The fact that the State board of agriculture, through the president of the college, now directs all agricultural activities in the State makes for coordination of all agricultural forces. The State department of public instruction and the extension division cordially cooperated. Public-school teachers have worked in excellent spirit with the county agents and State leaders in connection with the boys' and girls' club work. Extension forces were often called upon to aid in teachers' institute work.

The director of extension reports to the president of the college. The other members of the extension staff are an assistant director in charge of men's work, a State agent in charge of women's work, State club agent in charge of boys' and girls' club work, assistant club agent in boys' work, 23 men county agents, 20 women county

agents, 4 full-time specialists, and 4 part-time specialists. This shows an increase of 9 men county agents, 10 women county agents, and 1 assistant club agent. Part-time specialists are being replaced by full-time men.

Publications.—The publications for the year included the annual report of the director of extension for 1915-16, six bulletins relating to extension work, and a monthly serial entitled the "Farm Adviser." The bulletins were written by members of the extension staff. Material in the serial publications consisted of announcements of interest to extension workers and farmers, timely notes on the results of extension work in the State, and information of value to extension workers and farmers. Publications are distributed through a regular mailing list which consists of extension workers, college and station men, farmers, newspapers, and public officials.

Finances.—The funds available for the extension division for the fiscal year were:

United States Department of Agriculture, farmers' co-operative demonstration work	\$19,096.63
Federal Smith-Lever	24,202.34
State Smith-Lever	14,202.34
Other bureaus (United States Department of Agriculture)	2,861.43
State appropriation to counties	18,120.00
College and other funds	2,175.00
Total	80,657.79

Smith-Lever funds were used in support of the following projects: Administration, printing and distribution of publications, county agents, boys' clubs, home-demonstration work, agronomy, animal industry, dairying, horticulture, negro work, and hog cholera. United States Department of Agriculture funds were used in support of the following projects: Administration, county agents, boys' clubs, home-demonstration work, dairying, and negro work.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Much progress was made during the year in coordinating the work of the county agents with that of the specialists and in establishing the idea that the county agent is the point of contact in each county, and through him all activities of the college must be worked out.

The county agents have carried on their regular demonstration work faithfully during the year, in spite of the fact that Maryland more than any other State in the territory over which this office has supervision has been disturbed by the entrance of this country into

the war. The labor situation in many of the counties of the State has been most acute and it has been no small part of the work of the county agent to aid the farmer in overcoming this serious difficulty. The State council of defense, in recognition of the good work the extension forces of the State were doing in aiding the farmers with their emergency problems, made available to the extension division and to the college of agriculture \$25,000 to be used for traveling expenses and clerical help.

Demonstrations were carried on with corn, wheat, tobacco, oats, rye, buckwheat, mixed grasses, soy beans, alfalfa, crimson clover, red clover, cowpeas, Irish potatoes, orchard management, dairy work, cattle feeding, hog feeding, sheep feeding, poultry work, live-stock disease prevention, fertilizer, silo building, use of lime, perfection of farmers' organizations, etc. The county agents spent 75.5 of their time in the field and 24.5 in the office. The following is a partial summary of their activities:

Official visits to demonstrators numbered 4,735; to cooperators, 2,049; to other farmers, 7,370; to business men, 1,617; to boys' and girls' club members, 2,901; farmers' meetings held, 1,874; meetings of all kinds addressed, 2,483; total attendance at such meetings, 140,029; field meetings held, 465; attendance at these meetings, 8,119; number of official letters written, 25,295; articles prepared for publication, 5,100; circular letters prepared and sent out, 27,146; bulletins and circulars of the United States Department of Agriculture distributed, 15,631; bulletins and circulars from the State college of agriculture, 5,884; visits to schools, 1,133; schools assisting the outlining of agricultural courses, 145; extension schools assisted, 27; total attendance, 3,609. Practical demonstrations were held in each county resulting in the sale of 27 tractors to farmers in the State. The agents assisted in putting on 103 demonstrations on home orchards, containing 47,879 trees; gave assistance in spraying, pruning, etc., in 443 orchards containing 148,661 trees; influenced the planting of 19 orchards containing 1,851 trees; advised 2,192 farmers with reference to the use of fertilizer; conducted 79 fertilizer demonstrations; assisted 18 communities in cooperative buying of fertilizer, the amount bought amounting to \$26,290 with a saving of \$4,134; assisted in building of 79 silos; influenced 992 farmers to use lime with a total of 9,302 tons; assisted in the organization of 162 farmers' clubs with a total membership of 12,685; assisted in erecting 126 buildings and improving 180 buildings; furnished plans for 65 buildings; installed 69 home water systems, 190 home lighting systems; improved sanitary conditions on 302 farms; established 12 new pastures; 82 drainage systems; started or improved 564 gardens; induced 1,054 farmers to save surplus products for winter use; influenced 3,502 farmers to plant winter cover crops.

The following table gives results of work carried on by the agents with field crops:

Results of work carried on by the agents with field crops.

Crop.	Demonstrators.				Cooperators.			Demonstrations.	Total in-acre-
	Number.	Number reporting.	Acreage.	Average yield per acre.	Number.	Acreage.	Average yield per acre.		
Corn.....	235	215	1,516	69 bushels....	619	3,206	56.6 bushels...	834	4,722
Tobacco.....	47	27	237	1,350 pounds..				27	237
Wheat.....	158	97	1,933	26.7 bushels..	303	3,119	22.1 bushels...	400	5,052
Oats.....	14	7	172	40 bushels....	15	300	40 bushels....	22	472
Rye.....	17	41	920	25 bushels....	81	858	19.2 bushels..	122	1,778
Buckwheat.....	9	9	97	19.2 bushels..	7	31	.....	16	128
Alfalfa.....	208	157	1,122	3.9 tons.....	155	1,156	3.3 tons.....	312	2,278
Crimson clover.....	120	40	675	2 tons.....	209	340	1 ton.....	260	1,015
Mixed grasses.....	22	19	216	3 tons.....	25	75	2½ tons.....	44	291
Millet.....	5	5	25	3 tons.....			.....	3	25
Sudan grass.....	20	14	153	4½ tons.....	10	50	3 tons.....	24	203
Sweet clover.....	11	8	44	2.3 tons.....			.....	8	44
Vetch mixtures.....	14	11	64	1½ tons.....			.....	11	64
Cowpeas.....	119	42	1,144	1.97 tons or 15 bushels.	65	550	1.79 tons or 13 bushels.	107	1,694
Soy beans.....	117	102	571	13.3 bushels or 2.4 tons.	62	247	18 bushels or 2.43 tons.	164	818
Navy beans.....	56	46	92	.....			.....	46	92
Potatoes.....	205	149	743	159 bushels....			.....	149	743
Totals.....	1,378	989	9,724	.....	1,562	9,932	.....	2,351	19,656

Because of the agents' activities, there were brought into the State 27 pure-bred horses, 261 pure-bred dairy animals, and 702 grades; 77 pure-bred beef animals and 145 grades; 177 pure-bred hogs; 84 pure-bred sheep, and 124 grades for breeding purposes. There were 60 dairy demonstrations with 87½ cows; 5 cow-testing associations were formed; 2 beef-feeding demonstrations were held with 33 cattle; 33 hog-feeding demonstrations with 891 hogs; 6 sheep-feeding demonstrations with 289 sheep; 57 poultry demonstrations with 12,738 fowls. Seven beef-breeding herds were started during the year, 60 herds of hogs, and 23 flocks of sheep. A great work has been done during the year in the prevention of live-stock diseases, especially hog cholera. Farmers have been induced to treat for various diseases and pests 511 cattle, 24,622 hogs, and 506 horses.

Boys' clubs.—This work is supervised by the State agent and an assistant to the State agent for boys' club work. The work in the field is performed by his agent and the county agents cooperating with the school authorities and other organizations. Club work was carried on with corn, potatoes, tobacco, pigs, poultry, and calves. The total number of boys enrolled in corn clubs was 467, number reporting 207, number of bushels reported 12,427, average cost per bushel 33 cents, average bushels per acre 60; number of boys enrolled in pig clubs 135, number reporting 46, number pounds of pork produced 9,618, average pounds daily gain per pig 1.13, total value of

pork \$1,731.33; number of boys in potato clubs 350, number reporting 148, average number of bushels per acre 162.57, total production 3,007.58; boys enrolled in poultry clubs 117; number reporting 15; number of boys in calf clubs 15, number reporting 4; number of boys enrolled in tobacco clubs 30, number reporting 15, average number of pounds per acre 700; number of boys enrolled in garden clubs 98, number reporting 60, value of vegetables produced in gardens \$500; boys enrolled and reporting in miscellaneous clubs 7; total number of boys reporting 502; total value of products produced \$30,545.43.

Home-demonstration work.—During the year there were engaged in girls' club work a State agent, assistant State agent, and 20 county agents. In addition to these there were employed part of the time assistant agents in four counties, and five colored workers.

In canning clubs 1,316 girls were enrolled, 421 making reports; poultry clubs 144 enrolled, 90 making reports. Canning-club members packed 73,797 containers of fruits and vegetables. Club members made the following articles: 421 holders, 493 towels, 255 bags, 397 caps, 391 aprons, and 92 dresses. One hundred and sixteen clubs held 1,235 meetings during the year. In each of the counties one or two community fairs were held where large displays of products were exhibited. In almost every county local aid has been received through the county school commissioners, or county commissioners, to help finance the home-demonstration work. In two counties private individuals were sufficiently interested partly to finance the work. More poultry has been raised, more gardens planted, and more products canned than ever before since the work was organized.

There are 71 women's clubs, with a total enrollment of 1,036 in 10 different counties of the State. During the year county agents gave a total of 773 demonstrations, with a total attendance of 6,433. Demonstrations were conducted by women in 122 homes under county agents' instructions. Three hundred and forty-nine labor-saving devices were installed in homes, 41 houses were screened, and 30 winter gardens started. Through the State agents and county agents there were reached during the year 18,897 girls and women, and 170,042 containers were packed with fruit and vegetables. The amount of fruit and vegetables dried was 26,425 pounds, and 7,105 pounds of vegetables were brined and stored. During the year county agents held 2,953 consultations, sent out 6,313 circulars, made 5,584 visits to demonstrators, schools, and others; held 2,417 meetings, with an attendance of 48,405; wrote 4,868 letters, distributed 11,699 bulletins, and traveled 54,565 miles.

Agronomy.—One full-time specialist devoted his time to this project. He aided the county agents in conducting definite demonstrations in field corn, sugar corn, wheat, soy beans, field beans,

alfalfa, pasture, forage crops, and tobacco. Special effort was made by the specialist to encourage the growing of seed corn of high grade in selected communities in parts of the State where good seed is not now grown. Special effort was made to introduce soy beans and to have the crop grown under the direction of the specialist. To this end 60 bushels of the better varieties of seed were distributed through the county agents to about that number of farmers in quantities varying from $\frac{1}{2}$ to $1\frac{1}{2}$ bushels to be used in demonstrations.

The agronomy specialist's work may be summarized as follows: Addresses delivered, 54; movable schools visited, 3; circulars prepared, 14; letters written, 630; exhibits judged, 6; demonstrations visited, 113; and miles traveled, 6,000.

Animal industry.—One specialist, with the assistance of hog-cholera specialists of the United States Department of Agriculture, was in charge of this project. This is the first year this project has been in existence, and it was the main purpose of the specialist to make a campaign against contagious and infectious diseases of live stock before attempting to encourage stockmen to increase live-stock production. To this end the work of the specialists was largely educational.

The greatest menace to the live-stock interests of the State being hog cholera, the specialist began this work by organizing local hog growers' associations with the immediate purpose of eradicating hog cholera in the State. Other diseases that have been given some attention are infectious abortion, tuberculosis, and parasitic infection. To protect the sheep industry and make it possible, an effort has been made to create a sentiment looking to the suppression of the dog menace. The specialist's activities may be summarized as follows: Traveled 6,172 miles, addressed 66 meetings, and aided in movable-school work. The following is a summary of the specialists who assisted during part of the year in the hog-cholera campaign: Meetings held, 160; attendance, 5,509; demonstrations, 77; attendance at demonstrations, 1,063; organizations formed, 111; membership, 1,908; bulletins distributed, 8,204; farmers visited to give instruction, 482; persons instructed other than at meetings, 1,195; personal instruction to administer serum, 700; miles traveled, 20,595.

Dairying.—One full-time specialist was leader of this project. The past year has been a most critical one for the dairy interests of the State due to the high price of grain and the greatly increased cost of labor. The foregoing conditions have emphasized the importance of community breeding clubs, cow-testing associations, individual herd records, and the growing of silage and legume hay. These points have been pushed by the specialist, and are being appreciated by the dairymen of the State. There are 9 cow-testing asso-

ciations with 150 herds and 2,882 cows. Accurate records kept during the past 5 years show greatly increased production due to cow testing and record keeping; unprofitable animals have been eliminated, better methods of feeding and management have been adopted. Due to the specialists' efforts, practically all members of cow-testing associations are using pure-bred bulls. Three carloads of pure-bred Guernsey and Hereford cows have been bought and distributed in Dorchester, Somerset, and Alleghany Counties during the year. Seventy silos have been built and much information has been given to dairymen with reference to silage crops. Visits were made to 45 farms, and 30 lectures were delivered on dairy subjects.

Horticulture.—One full-time specialist is leader of this project. Campaigns have been conducted against insects and diseases. Demonstrations in planting, pruning, syringing, cultivation, and harvesting of fruits have been conducted. Campaigns for home gardens have been made; 57 visits were made with county agents for the purpose of giving advice in regard to the use of fertilizer in orchards; 45 visits made in company with county agents to give instruction with reference to home gardens; fruit growers' meetings were held and much time was spent in securing seed potatoes, soy beans, cow-peas, and navy beans to be distributed through county agents to growers. A bulletin on gardening was prepared and circulars on potatoes, sweet potatoes, onions, and strawberries were written. The following is a summary of the field work of the specialist during the year: Fruit growers' meetings attended, 20; orchards visited with county agents, 57; orchard demonstrations other than the above, 60; garden clubs visited, 7; club meetings attended, 2; truck farmers visited, 8; visits to gardens, 46; permanent home orchard demonstrations, 16; and commercial orchard demonstrations, 2.

Rural organization.—This project is under one part-time leader. It has been the purpose of the leader of this project to encourage all organizations in existence to assist county agents in forming county agricultural councils and community farmers' clubs; to encourage the formation of farm-loan associations, and special associations such as the Garrett County Sheep Growers' Association, the Western Maryland Sweet Potato Association, and the like. The specialist prepared a bulletin on the Federal Farm Loan Act and the Farmer, and a bulletin on the Torrens System of Land Title Registration. One hundred and sixty-two farmers' clubs were organized with a membership of 12,695.

MISSISSIPPI.

Division of Extension, Agricultural and Mechanical College, Agricultural College.

E. R. LLOYD, *Director*.

Organization and administration.—The same general plans of work were carried out during the fiscal year as were in operation last year. There were no important changes in the administrative force. There are now in force 15 approved projects.

In addition to the continuance of the regular field demonstrations with staple crops, special emphasis was laid during the year on increased production of food crops, community organization, and cooperative marketing.

Cordial cooperative relations have been maintained between the extension division and other agencies in the State as in the previous year.

Publications.—Ten circulars and nine one-page circular letters were issued by the extension division in 1916-17. During the year 1,112,000 copies of circulars and 59,400 copies of circular letters were issued. In addition to the bulletins and circular letters, plate material was furnished to the press of the State each week, giving timely information on important subjects in agriculture and home economics.

Finances.—The following funds were expended for cooperative extension work in agriculture and home economics for the year ending June 30, 1917:

United States Department of Agriculture, farmers' cooperative demonstration work-----	\$43, 638. 80
United States Department of Agriculture, other bureaus-----	8, 085. 89
Smith-Lever, Federal -----	45, 437. 14
Smith-Lever, State appropriation-----	13, 000. 00
Smith-Lever, county appropriation-----	22, 437. 14
State-----	11, 937. 29
County appropriation (not Smith-Lever offsets)-----	15, 813. 95
Other appropriations within the State-----	6, 184. 77
Total -----	166, 534. 98

Smith-Lever funds were used in support of the following projects: Administration, printing and distribution, county agents, home economics, extension schools and farmers' courses, boys' club work, girls' club work, community organizations, farm management, market clubs, rural engineering, animal husbandry, horticultural extension, and dairy extension.

United States Department of Agriculture funds were used in support of the following projects: Administration, county agents, boys'

clubs, and home economics and girls' club work. Funds from the Bureau of Animal Industry, United States Department of Agriculture, were used in support of dairying and live stock in tick-free area. Movable schools and agricultural teaching were supported entirely from State funds.

A detailed statement of receipts and expenditures has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—There were employed in county-agent work at the beginning of the year 1916-17, 43 county agents, and at the end of the year, 58.

Demonstrations with various crops were made with 10,330 farmers during the year. In addition to the regular lines of work carried on with crop demonstration the agents devoted a large part of their time during the year to the increase of food and feed crops throughout the State.

The following is a summary of some of the activities of the county agents during the year: Held 8,163 meetings, with a total attendance of 295,013; wrote 49,069 official letters; prepared 1,821 articles for publication; sent out 154,736 publications from the United States Department of Agriculture; distributed 22,217 bulletins and circulars of the agriculture college; conducted 435 demonstrations in corn—average yield, 39.29 bushels per acre; 169 cotton demonstrations—average yield, 1,210 pounds of seed cotton per acre; 218 oat demonstrations—average yield, 31.59 bushels; 271 wheat demonstrations—average yield, 18.87 bushels; 70 rye demonstrations—average yield, 16.72 bushels; 70 alfalfa demonstrations—average yield, 3.75 tons; 77 bur-clover demonstrations—average yield, 3 tons per acre; 102 crimson-clover demonstrations—average yield, 1.94 tons; 5 red-clover demonstrations—average yield, 2 tons per acre; 474 lespedeza demonstrations—average yield, 1.93 tons per acre; 34 hay-crop demonstrations—average yield, 3.75 tons per acre; 45 sorghum-hay demonstrations—average yield, 2 tons per acre; 1,291 velvet-bean demonstrations—average yield, 29.9 bushels per acre; 328 soy-bean demonstrations—average yield, 22.17 bushels per acre; 62 peanut demonstrations—average yield, 32.02 bushels per acre; 125 cowpea demonstrations—average yield, 12.23 bushels per acre; 54 sweet-potato demonstrations—average yield, 133.73 bushels per acre; 138 Irish-potato demonstrations—average yield, 74.61 bushels per acre; number of pure-bred stallions brought into the counties through agents' influence, 20; jacks, 25; brood mares, 471; demonstrations in feeding horses and mules, 644; pure-bred dairy cattle brought into the counties through the influence of agents, bulls, 215; cows or heifers, 1,443; number of grade dairy cows brought in, 1,317; pure-

bred beef cattle brought into counties during the fiscal year, bulls, 353; cows or heifers, 397; grade-beef cows brought in for breeding purposes, 2,667; breeding herds started, 203; beef cattle-feeding demonstrations supervised by agents, 72; local beef cattle breeders' associations, 32; pure-bred hogs brought into counties through agents' work, boars, 882; sows or gilts, 4,239; hog-feeding demonstrations supervised, 241; grazing-crop demonstrations for hogs, 4,607; pure-bred rams brought into counties, 115; ewes, 65; grade ewes brought into the counties for breeding purposes, 2,264; number of flocks started, 140; poultry demonstrations, 110; cattle treated for blackleg and other diseases, 97,681; hogs treated for cholera and other diseases, 188,930; horses treated for spinal meningitis, 32; horses treated for anthrax, 8,320; farmers advised regarding proper use of fertilizer, 9,759; lime demonstrations, 323; silos constructed through agents' influence, 171; plans furnished for farm buildings, 261; number of home-lighting systems installed, 147; farmers induced to save surplus farm products for winter use, 10,151; number of schools where the agents assisted in outlining courses in agriculture, 106; pasture demonstrations, 662; home orchard demonstrations, 276; drainage systems installed under agents' supervision, 122; terracing demonstrations, 4,056; demonstration exhibits installed at 37 county fairs; number of farmers' clubs organized, 384; number of cars of diversified farm products marketed cooperatively through agents' influence, 1,272. There was nearly a 50 per cent increase in the production of corn; 100 per cent increase in the production of velvet beans; 50 per cent increase in the amount of sorghum sirup produced; and a very large increase in the yield of such crops as peas, soy beans, and peanuts. The planting of home gardens was practically State wide. The amount of fruits and vegetables stored for winter use was double that of any previous year. There was also a very substantial increase in the number of hogs grown for market, and the production of hogs during the coming year will be greatly increased.

There was expended under this project for the fiscal year the sum of \$80,926.

Boys' agricultural clubs.—The boys' agricultural-club work was concentrated upon three lines of work, viz, corn clubs, pig clubs, and calf clubs. The enrollment in the corn club was 5,072. The average yield of boys in the corn club was 53.3 bushels per acre, at an average cost of 43 cents per bushel. One hundred boys made an average yield of 102.39 bushels per acre, at an average cost of 27 cents per bushel.

County club schools were held in practically every county in the State, where the boys were given instruction in the proper cultivation and the methods of feeding hogs and cattle.

Pig clubs.—Four thousand two hundred and twenty-six boys were enrolled in the pig clubs, each of whom was supplied with a pure-

bred pig. Through the influence of the pig clubs, pure-bred hogs have been placed in every community in the State.

Calf clubs.—Three hundred and thirty-two boys were enrolled in the calf clubs. The average profit per member in the calf clubs was \$27.08; the average cost per pound of gain of baby beeves grown by the boys was 4.2 cents.

Farm-makers' club for negro boys.—One thousand seven hundred and thirty negro boys were enrolled in what are known as farm-makers' clubs. These boys conducted demonstrations with corn and pigs. The average yield of corn raised by negro boys in clubs was 46.22 bushels per acre, at an average cost of 31 cents per bushel.

There was expended under this project for the fiscal year the sum of \$15,719.

Farm-demonstration work for negroes.—It has been the duty of all white agents to take negro demonstrators from the beginning, and by this means it has been possible to give a great deal of assistance to negro farmers. One negro district agent and nine negro local agents were employed in Mississippi during the year 1917. Work among the negroes is conducted along exactly the same lines as are followed in demonstration work among white people. The specialists in the extension department assisted in holding meetings from time to time for negro farmers throughout the State.

The following are some of the results accomplished by negro agents in 1917: One hundred and forty-nine corn demonstrations, with an average yield of 42.84 bushels per acre; 146 cotton demonstrations, average yield, 746.7 pounds of seed cotton per acre; 13 wheat demonstrations, average yield, 37 bushels per acre; 29 rye demonstrations; 83 oats demonstrations, average yield of 35.82 bushels per acre; 82 alfalfa demonstrations, average yield of 2½ tons per acre; 5 crimson clover demonstrations, average yield of 2½ tons per acre; 34 Sudan grass demonstrations for hay, average yield of 5 tons per acre; 70 sorghum demonstrations for hay, average yield of 4 tons per acre; 12 mixed grass demonstrations for hay, average yield of 2½ tons per acre; 5 oats and vetch demonstrations for hay, average yield of 2 tons per acre; 12 lespedeza demonstrations, average yield of 4 tons per acre; 153 cowpea demonstrations, average yield of grain per acre, 29.64 bushels; 33 soy-bean demonstrations, average yield of 23.65 bushels per acre; 18 velvet-bean demonstrations, average yield of 21 bushels per acre; 42 peanut demonstrations, average yield of 27.3 bushels per acre; 135 sorghum demonstrations, average yield of 27 gallons per acre; 35 Irish-potato demonstrations, average yield of 50 bushels per acre; 65 sweet-potato demonstrations, average yield of 83.49 bushels per acre; 195 home orchard demonstrations; 52 poultry demonstrations.

A large part of the time of the negro agents was devoted to stimulating an interest in having a good garden and sufficient food and feed crops for home needs. The work along this line was very satisfactory.

Home demonstration and girls' club work.—Forty women county agents were employed at the beginning of the year, and 53 at the close. During the year 10,380 girls were enrolled in the canning clubs and 2,783 in the poultry clubs. The work was organized in 64 counties.

Some of the results accomplished among the girls during the year were as follows: Cans and jars of vegetables put up from home gardens, 1,971,303; number of containers of fruit put up from home orchards in tin and glass, 99,778; number of girls making bread demonstrations, 834; girls giving cooking demonstrations, 2,643; winter gardens planted, 1,530; miscellaneous articles of home convenience made by girls in canning club, 465.

There were enrolled in home-demonstration work 5,450 farm women; 849 women were enrolled in poultry clubs. There were organized among farm women 444 community clubs for studying cooking, gardening, and poultry raising. Number of bread-making demonstrations given, 1,236; number of fireless cookers made, 1,537; iceless refrigerators, 1,344; kitchen cabinets, 532; wheel trays, 258; ironing boards, 56; water systems installed, 200; houses screened through agents' influence, 244; number of pounds of butter made under supervision of agents in making demonstrations, 16,686; rest rooms installed in cities for farm women, 16; egg circles organized, 56; containers of fruit and vegetables packed by members of home-demonstration clubs, 509,518; number of pounds of dried fruits and vegetables stored, 19,865; gallons of brined vegetables stored, 6,602.

The efforts of the home-demonstration agents for securing an all-year garden at every home were very successful, and more attention was given to the planting and care of home gardens than in any previous year. There was possibly an increase of 100 per cent in the amount of fruit and vegetables stored in 1917 over any previous year.

There was expended during the fiscal year in the home-demonstration and girls' club work project the sum of \$34,288.

Animal husbandry.—Work under this project was carried on in cooperation with the Bureau of Animal Industry, United States Department of Agriculture. Two specialists were employed. Considerable stress was given to the conservation of cows and heifers and the use of pure-bred bulls as outstanding features of the work with beef cattle in 1917. A conservative estimate of the number of grade and pure-bred beef cattle brought in during the year is 15,000 head. Attention was also given to the growing of more work stock on

farms. An effort was made to introduce pure-bred stallions and jacks in all counties of the State.

A compilation was made during the year of the pure-bred live stock on Mississippi farms, in order to find out the localities where pure-bred animals are most needed. Two State-wide beef-cattle associations were formed during the year. Fifty-two cars of beef cattle were fattened for market under the directions of the specialist of this division. Two bulletins were issued.

Dairying.—The work under this project is carried on in cooperation with the Dairy Division, Bureau of Animal Industry, United States Department of Agriculture. Three specialists were employed during the year. There has been a remarkable growth in the dairy industry in Mississippi in the past four years. At the present time 22 creameries are in operation, with something like 100,000 cows furnishing milk for them. Records have been kept during the year on 47 herds. Nine pure-bred dairy bulls have been placed by the extension division. Several carloads of dairy cattle have been brought into the State during the year through the efforts of the extension specialists. Plans have been furnished for dairy barns and milk houses. Special effort has been made to assist the creameries in turning out a high-class quality of dairy products. Fifty-three meetings have been held during the year for instructing farmers on dairy subjects.

Community organization.—One specialist was employed under this project. The principal line of work has been in organizing market clubs throughout the State. Ninety clubs were organized in 1916 and market clubs have been organized in 26 new counties during 1917. The work is carried on in cooperation with county agents and consists in marketing diversified farm products in car lots where the local market for such products is not well established. This work has been very helpful to the farmers in disposing of diversified products at good prices.

Marketing.—One specialist was employed under this project. The work consisted mainly in assisting truck growers in the proper grading and packing of products for market and in aiding the truckers of the State in perfecting organizations for cooperative shipping of truck crops. In addition to the work done among the truckers, an organization was perfected among the sirup growers for cooperative marketing of sirup. It is estimated that this service aided the growers in advantageously marketing 600 cars of truck crops and other farm products during the year.

Agricultural engineering.—Two specialists were employed under this project. The work consisted mainly in furnishing blue prints and specifications for farm buildings, such as farm dwellings, barns, hog houses, and silos. Work was also carried on in putting in sys-

tems of farm drainage and home waterworks. Three thousand letters were sent out, giving instructions on various farm-engineering problems, and 6,100 blue prints of various types of farm buildings were mailed upon request. Two circulars were issued by the division during the year. During the month of November, 1916, a one-week campaign was put on in every county in the State to create interest in installing home waterworks systems.

Horticulture.—One specialist was employed under this project. The specialist took part in seven short courses for farmers and also assisted in a large number of one-day farm meetings. One bulletin was issued during the year. The specialist has given valuable assistance to county agents in preparing instructions on management of the home orchards and gardens, control of insect pests, and crop diseases. A very successful special campaign was conducted in the fall of 1916 for pruning and spraying orchards.

Farm management and information service.—Two-thirds of the time of the specialist in farm management was devoted to extension work and one-third to teaching. Farm surveys were carried on in 1916 on 120 farms, and in 1917 on 75 farms. This farm-survey work was carried out in three selected areas of the State and financial statements of results tabulated. The results of these surveys were furnished to county agents and farmers as a means of showing the advantages of a properly balanced system of farming.

In addition to the farm surveys made, the specialists of this department assisted in editing all news articles and bulletins prepared for distribution.

Movable schools.—One specialist was employed to conduct movable schools. During the fiscal year, 1916-17, 133 farmers' meetings were held in the State, with a total attendance of 46,107 people. The work consisted principally of one-day meetings.

OUTLOOK.

During the year the extension force accomplished remarkably good work in pushing the production and conservation of food and feed crops. There was practically a 50 per cent increase in the corn crop, and a 100 per cent increase in velvet beans, peanuts, and soy beans. There was also a large increase in the number of hogs and beef cattle. There was fully a 100 per cent increase in the amount of fruits and vegetables stored for winter use in 1917 over that of previous years.

The standard of efficiency of the men and women employed in the extension service is much higher than it has ever been before. Hearty cooperation was secured from county authorities in providing funds for payments of salaries of county agents. The leaders

of the work felt it was more important to strengthen and expand the lines of work already begun than to take up new features. An excellent spirit of cooperation prevails among the extension workers and the outlook for the work could not be better.

NORTH CAROLINA.

Extension Division, College of Agriculture and Mechanic Arts, and State Department of Agriculture, Raleigh.

B. W. KILGORE, *Director*.

Organization and administration.—The extension work was continued under the same general plans as outlined in previous reports, but the scope of activities was greatly enlarged as a result of the urgent demand upon the farmer for increased food production.

The administrative force was increased on account of the food production and conservation campaigns. An assistant to the director, two men district agents, and two women district agents were appointed. Three specialists resigned to take positions with the United States Department of Agriculture, three left for Army service, and one went to another State. The pig-club agent resigned to take up private work, and several county agents either joined the Army or took up private work. A sheep specialist was added to the animal-husbandry division. The personnel at the close of the fiscal year was a director, a State agent for men, a State agent for women, 5 men district agents, 4 women district agents, 71 county agents, 4 negro agents, 60 women county agents, 21 full-time specialists, and 4 part-time specialists.

Pleasant cooperative working relations were continued with the State department of agriculture, State agricultural college and experiment station, the State normal and industrial college, the State department of education, farmers' union, negro agricultural and technical college, the county commissioners, railroads, boards of trade, chambers of commerce, banks, and various other commercial and farmers' organizations. Especially friendly and helpful relations were maintained with the press of the State.

Publications.—Owing to the emergency demand, the editor was taken somewhat from his usual routine to prepare special publicity articles on food and feed crops, timely posters and bulletins, special articles for Sunday papers, and to inaugurate a daily news service to the papers. In addition to this special work, the editorial office edited and mailed 1,800 copies of the Extension Farm News each week during the year; issued 38 extension circulars, with a total of 480 pages (206,650 copies); and sent out great quantities of multi-graph matter for the extension service. The additional work was

handled satisfactorily by the installation of modern, up-to-date office equipment.

Finances.—The funds expended for the extension work for 1916-17 were as follows:

Federal Smith-Lever-----	\$52, 079. 86
State Smith-Lever-----	42, 079. 86
United States Department of Agriculture, farmers' co-operative demonstration work-----	43, 164. 37
United States Department of Agriculture, other bureaus-----	11, 573. 72
County appropriation-----	95, 000. 00
State Department of Agriculture-----	38, 570. 00
Total-----	282, 467. 81

Smith-Lever funds were expended on the following projects: Administration, printing, county agents, home demonstration, boys' clubs, dairying, fruit and truck, agronomy, cotton grading and marketing, negro clubs, drainage, beef cattle and sheep, rural communities, animal diseases, and beekeeping.

Funds from the United States Department of Agriculture were expended on the following projects: Administration, county agents, home demonstration, boys' clubs, dairying, negro clubs, beef cattle and sheep, and beekeeping.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—At the close of the fiscal year there were engaged on this project a State agent, 5 district agents, 71 county agents, and 4 negro local agents. Never before has the work of the county agents been so strenuous. Besides taking the lead in the food-production campaign, they were asked to make all kinds of surveys, assist in raising funds for various war purposes, and numerous other kinds of emergency work. Plans for the regular work were more or less upset; but, on the whole, the conditions were successfully met, and practically all the people were reached in some rather direct way. The extraordinary efforts of the county agents are reflected in the largest corn crop in the history of the State, a material increase of all kinds of small grain, and more gardens, home orchards and poultry products. Conservation work was carried on under the general direction of the agents. One particularly good piece of conservation work was the effort fostered largely by the agent for the eradication of hog cholera. About 55,000 hogs were inoculated. A large number of other animals were treated for various diseases.

The influence of the work now reaches, in some direct way, almost every North Carolina farm. This is plainly indicated by the increased production and general prosperity of the agricultural districts. There were 1,954 corn demonstrations, embracing 25,932 acres, yielding 48.7 bushels per acre, against 28 bushels under the usual methods; 417 cotton demonstrations, with an average yield of 1,152 pounds of seed cotton per acre; 1,903 wheat demonstrations, with 11,020 acres, yielding 28 bushels per acre, or an increase of 12 bushels over the average yield for the State; 604 oats demonstrations, yielding 34 bushels per acre; 1,409 clover demonstrations, yielding 2 tons of hay per acre; 1,064 soy-bean demonstrations, 2,857 acres, giving 17.8 bushels of seed per acre and 2.4 tons of hay; 1,068 velvet-bean demonstrations, yielding 23 bushels per acre; 990 cowpea demonstrations. The agents helped to start 723 new home orchards, with 60,425 trees, and helped to prune, spray, or in some way treat more than 339,400 trees.

The number of pure-bred animals brought into the State during the year was 117 horses, 545 dairy cattle, 350 beef cattle, 2,944 hogs and 133 sheep. There were 802 poultry demonstrations, comprising 30,924 birds; 1,447 cattle were treated for blackleg; and 54,821 hogs treated for cholera. There were constructed 180 dipping vats and 117 silos, making a total of 576 silos in the State at this time. Twenty-nine farm buildings were erected; 674 were improved; 238 plans furnished; 190 water and 921 lighting systems were installed; 6,687 houses screened; 1,820 flytraps installed; 1,336 telephone systems installed; 916 new pastures started; 608 drainage systems established; stumps removed from 927 farms; 1,957 farms terraced; 14,837 home gardens planted; 20,127 farmers planted 125,138 acres of cover crops to be turned under for fertilizer; 5,045 farmers used lime; 51,196 tons of fertilizer were bought cooperatively; saving \$53,827 to farmers. New implements were bought as follows: One hundred and thirty-two binders, 433 mowers, 340 hayrakes, 75 hay presses, 518 grain drills, 100 ensilage cutters, 250 gas engines, 644 disk harrows, 144 cream separators, 326 two-horse cultivators, 427 spraying machines, and 12,500 small tools.

The agents organized 199 farmers' clubs, with 5,665 members; total number of visits made by agents, 71,838; miles traveled, 457,424; office calls for information, 51,439; farmers' meetings held under the auspices of the county agent, 2,890, attendance, 251,817; field meetings, 1,055, attendance, 14,488; 45,750 official letters written; 1,755 articles prepared for publication; 52,222 circular letters sent; 76,721 department bulletins distributed and 36,003 State bulletins; 1,998 schools visited in connection with the club work; 51 extension schools or short courses held, attendance, 6,744; 984 farmers kept cost records; 1,496 farmers are growing improved seed for sale; 150 woodlots

kept; 6,022 farmers grew sorghum for sirup; 2,493 farmers grew practically all of their home supplies; 84 per cent of the demonstrators and farmers are decreasing their indebtedness.

Negro work.—Four regular negro agents were employed during the year. Their work has been reported in connection with the white agents' work, but it is safe to say that practically as much progress has been made among the negroes in those communities where negro agents worked as among the white farmers. All white agents are required to assist the negro farmers and to enlist negro demonstrators in counties where there is a large negro population not served by a negro agent.

Boys' club work.—War conditions required a modification of plans for this work, as well as for all other agricultural activities. When war was declared the list for regular corn-club demonstrations had already been practically completed; but, realizing the necessity for growing more food products, an additional emergency list was secured. The assistant State agent in club work supervised all club work in the State. Under him is an assistant in charge of each branch of the work.

The total enrollment for the boys' agricultural clubs was 8,667, classified as follows: Corn, 3,652; potatoes, 342; cotton, 120; peanuts, 123; pigs, 1,900; poultry, 2,500; miscellaneous, 2,900. In farm-makers' clubs the enrollment was 1,423, making a grand total of 10,090.

The reports from the corn-club boys showed an average of 59.3 bushels per acre, at an average cost of 36 cents per bushel. Forty boys made 100 or more bushels per acre. Eleven of these were in Buncombe County.

Reports from potato-club members show a yield of 268 bushels per acre, at an average cost of 35 cents a bushel.

Cotton clubs averaged 913 pounds of seed cotton per acre and gave a profit of \$76.35 per acre. Peanuts averaged 46.6 bushels per acre and gave a profit of \$70.67.

Eighty-seven per cent of the boys reporting in pig clubs raised pigs registered or eligible to registry. The average profit on pigs in the fattening demonstrations was \$20.64; in the breeding demonstrations, \$34.17; in the sow and litter demonstrations, \$37.29. The average profit per member using grazing crops was \$35.62; of those not using grazing crops only \$30.06.

In the poultry clubs 41,613 eggs were set; 28,890 chicks were hatched and 21,830 were raised. Many prizes were won by members of the poultry clubs at the county and State fairs.

It is estimated that the boys in agricultural clubs increased the production of food and feed to the value of \$274,317.50. Exhibits were made by the clubs at State and county fairs. A boys' and girls'

short course was held at the agricultural and engineering college, with 560 members in attendance.

Farm-makers' club work for negro boys.—Under the leadership of the new agent in charge, negro club work made such progress that it was planned to add an assistant at the beginning of the next year. The farm-makers' club members made a creditable showing at the various negro fairs of the State. The sweepstake prize on corn at the State fair was won by a club member. Edgecombe County won the distinction of the largest total yield of corn by club members. Wake County had the distinction of growing the cheapest corn, produced at 16 cents per bushel. The average yield per acre by boys reporting in farm-makers' clubs was 51.4 bushels. Five of these boys made 100 or more bushels per acre; 22 made over 75 bushels. Eight hundred corn-club members and 51 poultry-club members were enrolled. The value of the poultry-club products reported by these clubs was \$1,400. It is estimated that the farm-makers' clubs produced food and feed to the value of \$62,350.

Home demonstration and girls' club work.—The home demonstration and girls' club work has made much progress during the year. The year was begun with 44 agents and closed with 64. Forty of these have had thorough home-economics training. It is not possible to estimate the amount of work these women agents did in promoting the food-production campaign and in conserving the products after they were grown. The December, 1916, enrollment was about 6,000 girls, but when the production campaign was put on this was increased to 12,000. It was estimated that 300,000 people in the villages and towns had organized themselves so as to receive some of the benefits of the instruction and advice of the home-demonstration agents. Every club member in North Carolina was instructed, and most of them pledged themselves to teach one other person the art of canning. From the reports received it would seem that they even exceeded this pledge many times. The demand upon the time of the county home-demonstration agent was very heavy during the vegetable and fruit season. Some counties not before interested in this work made liberal appropriations for an agent, and a few counties even furnished automobiles and travel expenses of agents in order that they might get over the county more rapidly. These agents stimulated community effort by introducing community canners, drying outfits, cooperative buying and selling associations, preparing exhibits at community, district, and State fairs, and improving home conditions.

Assistance and instruction have been given in making fireless cookers, iceless refrigerators, flytraps, screens, and in every way possible agents have aided and assisted the women with whom they have worked to realize a more wholesome, refreshing, and vigorous rural

life. The annual agents' meeting of home-demonstration agents was held shortly after war was declared. Plans were immediately laid and agents drilled for extraordinary work in producing and conserving food. Women's organizations in the larger cities were utilized and rendered valuable assistance in teaching women and girls how to can, dry, and preserve home products. Community canneries were established and operated in many instances by church organizations in mill villages, with the assistance of trained workers.

Some of the results of this work may be seen from the following summary: The club members put up 3,289,415 containers of fruit and vegetables. Women and girls outside of the regular organizations put up 5,488,847 containers, making a total of 8,778,262 containers. The total value was estimated at \$2,179,362; total profit, \$1,634,519. In counties without agents the supervisory agents gave some assistance. In addition to the canned goods, 288,566 gallons of vegetables were brined, and 557,853 pounds of fruits and vegetables dried. The products put up by the regular club members were marketed under the 4-H label; those put up by the women's organizations and girls who were not members of the clubs were marketed under the label: "Home Defense Brand." Heretofore the marketing of canning-club products had been confined largely to the State. Club girls are encouraged to sell their own products for the business training it gives them. Local dealers are usually glad to handle all their products when, after trial, they find their customers prefer them to any others. Home-canned products were exhibited and advertised at 59 community fairs, organized by home-demonstration agents in cooperation with county agents.

A great deal of assistance was given the women and girls in teaching the use of substitutes for flour in bread making, how to serve meatless dinners, cooking with vegetable fats, how to utilize leftovers, and in the making and placing of convenient kitchen outfits.

The following are some of the other conveniences not mentioned above which were placed in homes by the agents: 505 fireless cookers, 2,463 flytraps; 1,888 houses screened; 5,631 miscellaneous household articles placed; 439 water systems for rural homes; 13 community buildings established for permanent community center meetings; 4,918 winter gardens, against 60 recorded last year. Four thousand two hundred and ninety-two articles such as dresses, caps, aprons, etc., were made by the girls. The agents traveled during the year 219,740 miles; wrote 44,000 letters; mailed out 90,460 bulletins; held 6,070 meetings, with an attendance of 282,805; gave 7,800 demonstrations; and were called on in their offices by 42,270 persons.

Poultry clubs.—The work under this project was carried on in cooperation with the Bureau of Animal Industry. The specialist in poultry clubs reports that his work has made rapid progress dur-

ing the year. The enrollment was 1,852 white children and 693 negro children. Very great interest was manifested in this work in certain counties, especially in Anson, Buncombe, Catawba, Iredell, Lee, Mecklenburg, New, Hanover, Rutherford, Union, Wayne, Wilson, and Guilford. The poultry work is done in cooperation with the county agents in all instances. While the women agents have rendered, perhaps, the greatest assistance in this line, the men agents also rendered valuable assistance to the specialist and club organizers. The specialist has been very active himself, and he reports having appeared in 150 meetings, with a total attendance of 12,514. Of the number of members enrolled, 465 sent complete reports and histories of the work. The 465 reporting raised 11,192 birds, which were worth perhaps \$6,000. If those who did not report came anywhere near doing as well, it will be seen that this work is well worth while in the State; and, since it is becoming better known, it is believed that it will grow very much faster.

Agronomy.—The extension work in agronomy was grouped principally around soil improvement, increasing of crop yields, community improvement of corn and cotton seed, increased acreage of soy beans, improvement of small grains, attendance on farmers' meetings, fairs, and conferences with various organizations relating to the improvement of agricultural conditions. The specialists in the agronomy division have rendered valuable assistance to the county and home-demonstration agents. The work has been planned in cooperation, and the mutual benefits to the specialists and the agents are becoming more fully realized as the work progresses. A large number of demonstrations were carried on in the selection and improvement of one variety of cotton in the community. These are proving to be successful and very profitable to the farmers. Some varieties have been developed which have given an increased yield, amounting to from \$10 to \$30 per acre over the varieties previously grown. The division of agronomy has also cooperated with 11 of the farm life schools in 10 counties in having the students conduct demonstrations with fertilizers, varieties of crops, etc. All this work, together with the many meetings and conferences, preparation and distribution of publications of different kinds, have had an important influence. The farmers have become much more interested in soil types, soil improvement, and the better use of improved crops than heretofore.

Animal husbandry.—This project was carried on in cooperation with the Bureau of Animal Industry, United States Department of Agriculture, in the tick-freed areas of the State. The educational features of this work have been continued as last year. Specialists under this project have assisted in building 40 silos. Four pure-bred cattle sales were conducted during the year, at which 91 animals

were sold. A large number of pure-bred and grade animals were brought in outside of these sales. It is estimated that the total will exceed 200 head. The specialists in this project have visited 500 farmers during the year and given specific assistance to 1,124. A sheep specialist has been employed in cooperation with the United States Department of Agriculture, and this work has been well received and has made good progress. A survey of the State is being made to determine the number of sheep in each county at the present time, the amount they are taxed, and the number of dogs. Plans are being perfected for the organization of lamb-shipping associations and also for a wool association to handle this product. More than 500 letters were written in reply to inquiries regarding sheep. Special sheep meetings have been held in cooperation with the county agents in 11 counties.

Dairying.—The dairy extension work is in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture. There are six specialists under this project. The dairy industry, perhaps, has been subjected to more embarrassment by the high price of feeds than any other branch of the live-stock work. Butter and butter fats during the last three years have increased in value just about 50 per cent. Almost all other farm products have increased in value from 75 to 150 per cent. Unfortunately, a great many dairymen in North Carolina, as well as other States, have heretofore been in the habit of buying nearly all of their feed-stuffs. The high prices of these now make it imperative that they grow more feed products on their own farms, and the specialists have made strenuous efforts, in cooperation with the county agents, to bring this about. In addition to giving information on the care and feeding of the animals, attending dairy meetings, assisting the county agents in planning dairy work for their demonstrators, and things along this line, the dairy specialists have been called on to furnish plans and to assist in the building of silos, dairy barns, creameries, milk houses, and other dairy equipment. Thirteen silos have been constructed through the specialists this year; also 22 milk houses, 21 barns, 8 cooling troughs, and many other conveniences for the barn and dairy house. No creameries have been built during the year, but the specialists have cooperated with the management of those already in operation and rendered such advice and assistance as was possible to continue them on a successful basis through the present trying period.

The cheese-factory work in the mountain section of the State is proving very valuable. Twenty-one cheese factories are now in operation in this section, making a first-class product, and it has been necessary to add another specialist for this work. To relieve the

great difficulty in finding good cheese makers, selected young men from the factory communities are being sent to the college dairy school to take a special course in cheese making in order to qualify them to manage the factories in their communities. The establishment of these factories enables farmers to get a good price for their dairy products, which were before unsalable.

During the year 70 dairy schools have been held in communities where the dairy industry was an important question. There were in attendance 4,844 boys and girls and adults. Considerable attention was given to determining the cost of milk production. Boys and girls were induced to keep herd records. Bull associations for the buying and selling of dairy cattle were organized. Plans are being developed for making tests of dairy herds. It is thought that this will do a great deal in assisting the farmers to weed out the poor producers and establish in their herds only cows of sufficient value to make it profitable.

Fruit and truck.—Horticultural demonstration work was continued and greatly stimulated during the year. In cooperation with the county agents, the specialists have conducted demonstrations in pruning, selection of orchard sites, laying out orchards, and choosing varieties, especially for home orchards. Through the agents a campaign was conducted for establishing a model home orchard according to plans and methods outlined by the specialists in horticulture. Considerable time of the horticultural specialists was given to planning and helping to construct sweet-potato storage houses. A model storage house was constructed at the State fair as a demonstration. Four new storage houses were constructed during the year; 24 old buildings were remodeled for this purpose, and 45 men have signified their intention of building new houses next season. Drying and evaporation of fruits and vegetables were pushed. Circulars and letters of instruction were prepared on drying of fruits and vegetables. Some potato demonstrations were carried on, especially getting a late crop for seed. The horticulturist cooperated with the entomologist in the treatment of orchards, truck and garden crops, for pests and insects. During the year 40 orchards, containing 101,200 trees, were visited, examined, and treated for insects and pests. Public demonstrations in spraying were given, with a good attendance.

Beekeeping.—This work is carried on in cooperation with the Bureau of Entomology, United States Department of Agriculture. North Carolina has a great many bees, but until recent years little attention was given them. Very few were handled on a scientific or profitable basis. There was no unity of interest among the beekeepers. The specialists succeeded in organizing a beekeepers' asso-

ciation on January 11, 1917; 150 beekeepers were in attendance. Several local meetings have been held since, where special instruction was given on winter packing, manipulation and feeding of bees, the grading of the honey, etc. This work is carried on almost entirely in cooperation with county agents and well-informed beekeepers.

Drainage.—This project is in cooperation with the Office of Public Roads and Rural Engineering, and the work has been conducted along the same general lines as in previous years. During the year designs and reports for tile-drainage systems were made on 27 farms in 18 counties and portions of the systems installed on some of the farms. Preliminary examinations, surveys, designs, and reports were made on four farms in four counties, comprising a total area of about 1,300 acres. Several farms were visited to give assistance and instruction in the location of terraces. Three examinations of a preliminary nature for drainage systems were made and reports issued, covering a total of 18,500 acres.

Veterinary work.—The work under this project has been largely confined to the diseases of dairy cattle, with particular reference to contagious abortion. Attempts have been made to give information concerning the wide extent of the infection, how to recognize it in herds, and how to control it. As a result of the study along these lines it was found that nearly every dairy herd in the State has some infection as well as many beef-cattle herds.

Cotton marketing and grading.—This project provides for the giving of instruction in grading and classifying cotton. The Office of Markets and Rural Organization, United States Department of Agriculture, cooperated in the work. The system of cotton grading was continued on a more extended scale than the last report indicated. This has resulted in giving the farmer an average of \$1.15 a bale more than he would have received otherwise. In the cotton-grading work approximately 25,000 farmers were served, which represented about 65,000 bales of cotton. The samples, in most instances, were furnished by the ginner, located mostly in the eastern part of the State. The classifying stations were located at Charlotte, Fayetteville, Newport, Raleigh, Tarboro, Weldon, and Wilson. Aid was rendered groups of farmers in disposing of their cotton. One bulletin on the work was published.¹

A good start was made in the formation of credit unions, of which 15 were organized, with 527 members. Information was furnished concerning the price and marketing conditions of perishable fruits and vegetables. A daily wire service, a weekly price report, and monthly market review have been issued. An exchange was formed, with headquarters at Waynesville, for marketing Irish potatoes and

¹ U. S. Dept. Agr. Bul. 476, "The Study of Cotton Market Conditions in North Carolina with a View to their Improvement."

apples in the western part of the State. This had the effect of raising the price of potatoes in this locality 50 cents a sack for both members and nonmembers. The division has begun assisting in cooperative marketing of hogs and corn in connection with the county agents' work, and is planning to organize hog and corn shipping clubs at points where carload lots can be obtained.

OUTLOOK.

The extension work is now apparently assured of a successful and permanent future. A complete cooperative working relation has been established with all other institutions interested in the State's rural problems. The official, financial, and moral support of practically all the people serves as an inspiration to the leaders of this great educational organization. There is a notable improvement in the personnel of the force. The workers, as a rule, are young, energetic, capable, and filled to an unusual degree with the spirit of service. There is a well-grounded determination in the extension force to see their State in the front rank among those striving to carry out the national war program.

OKLAHOMA.

Extension Division, Agricultural and Mechanical College, Stillwater,
Oklahoma.

JAS. A. WILSON, *Director*.

Organization and administration.—The extension work was gradually broadened and developed during the past year and a number of new men were added to the personnel. James A. Wilson continued as director of the work, acting also as State agent. At the close of the year, in addition to the director, there were 3 assistants, 6 district agents, 63 men county agents, 4 assistant men county agents, 8 specialists, 24 home-demonstration agents, and 1 woman district agent. This was an increase of 2 district agents, 1 county agent, 4 assistant county agents, 2 specialists, 1 home-demonstration agent, and 1 woman district agent. In addition to the above, 3 men and 1 woman were employed less than one-half time.

The director of extension is continued as a member of the college faculty and close cooperative relations are maintained between the officials of the extension force and members of the college faculty and the experiment station staff.

The director is assisted by an assistant director and State agent, an assistant in charge of boys' club work, an assistant in charge of

home-demonstration and girls' club work, six district agents for county-agent work, and one woman district agent. The county agents make weekly reports in triplicate, one copy being sent direct to the Office of Extension Work in the South, one copy to the district agent, and one copy to the State director of extension. Many of the agents also send a copy of their report to the president of the State board of agriculture. Women agents make weekly reports in duplicate, one copy going to the Office of Extension Work in the South and the other to the assistant in charge of home-demonstration and girls' club work. The specialists connected with the extension staff make weekly reports in duplicate, one copy being sent to the director of extension and the other to the respective cooperating bureau or office in the United States Department of Agriculture.

By constitutional provision the State board of agriculture is the governing board of the State agricultural and mechanical college, and as such has control through the president of the college of the policies of the extension division. This creates a hearty spirit of cooperation between the activities of the board of agriculture and the extension work and eliminates all possible duplication of effort.

The State board of education, of which the State superintendent of public instruction is chairman, is cooperating heartily with the extension division. This board pays approximately one-half the cost of agricultural extension work for negroes which is carried on through the Negro Agricultural and Normal University at Langston, Okla.

Publications.—During the fiscal year 12 circulars were published, with a total of 144 pages; 14 leaflets, with a total of 21 pages; 48 different instruction cards and 4 poster bulletins. The total number printed amounted to 359,800 copies. Plate material was prepared for 71 weekly papers in the State for a period of four months. All printing is done at the college printing plant. Manuscript for circulars, bulletins, and instructions for club members and demonstrators is prepared by the leader of the various projects or the head of the department in the college, and is approved by the director before publication. The mailing list includes State officials, extension workers in other States, and other interested persons, to whom all circulars and bulletins are sent. Instructions to club members were prepared monthly by the club leader and sent in bulk to county agents, who stamp their signatures on the same and mail them under frank to club members.

Finances.—The following funds were expended for cooperative extension work in agriculture and home economics for the year ending June 30, 1917:

Federal Smith-Lever	\$39,801.59
State Smith-Lever	29,801.59
United States Department of Agriculture:	
Farmers' cooperative demonstration work	39,173.47
Bureau of Animal Industry (poultry)	1,658.23
Bureau of Animal Industry (dairying), 3 months ..	2,763.85
Bureau of Animal Industry (pig clubs)	1,935.51
Office of Markets (5 months)	509.09
Office of Farm Management	1,223.35
Allofment of college funds	5,817.38
County commissioners	30,749.85
Other sources within the State	18,333.19
Total	171,758.01

Smith-Lever funds were used in support of the following projects: Administration, printing and distribution of publications, county agents, boys' clubs, home-demonstration work, rural sanitation, movable schools, poultry clubs, pig clubs, dairying, marketing and rural organization. Funds from the United States Department of Agriculture were used in all of the above projects except printing and distribution of publications, which was supported entirely from Smith-Lever funds.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—The efforts of the extension division through the county agents to create effective working organizations of farmers in the several counties throughout the State cooperating in extension work was pushed with much vigor during the early months of the present fiscal year with results that were very beneficial when the outbreak of the war necessitated increased efforts for the increased production of food and the conservation of supplies on hand. These community organizations were also strong supporters of the councils of national defense organized in the counties, and the county agents were able to assist materially in organizing the various activities of their respective counties in the prosecution of any work desired by the State or National Governments. During the year 268 new clubs were organized with a total membership of 11,190. The majority of these clubs have a strong central organization, composed of delegates from local clubs organized for the purpose of supporting the work of the county agent. This organization work and the farm-demonstration work represent the main activities of the county agents. A general idea of the value of the work done by the county agents is shown in the following table which also illustrates the beneficial results from the better practices advocated by the agents as compared

with the average yields obtained on land not cultivated under the instruction of county agents as reported by the Bureau of Crop Estimates. This has been especially noticeable this year on account of the severe drought which occurred in the western half of the State, where crops in many instances were a total failure. In other instances on land properly worked or where care had been exercised in conservation of moisture good returns were made.

Some results of field-crop demonstrations in Oklahoma in 1917.

Crop.	Demonstrators.				Cooperators. ¹			Total.	
	Num-ber.	Re-port-ing.	Acre-age.	Aver-age yield per acre.	Num-ber.	Acre-age.	Aver-age yield per acre.	Demon-strations.	Acre-age.
Corn.....	532	340	8,035.5	² 28.46	1,845	43,007	² 19.7	2,185	51,042.5
Kafir.....	103	75	1,334	² 22.88	169	3,710	² 17	244	5,044
Cotton.....	512	350	9,214	³ 14.48	1,059	25,146	² 791.6	1,403	34,360
Wheat.....	208	140	9,647	² 25.98	305	17,100	² 14.97	445	26,747
Oats.....	156	107	4,345	² 50.16	404	11,290	² 38	511	15,635
Rye.....	22	15	340	² 15.81	89	316	² 24.75	104	656
Alfalfa.....	83	62	2,011	⁴ 3.58	402	5,616	⁴ 6.08	464	7,627
Sweet clover.....	325	197	2,507	1.54	320	5,568	⁴ 1	517	8,075
Cowpeas.....	185	93	1,714	² 17.76 ⁴ 1.5	6	315	² 15 ⁴ 1.5	99	2,029
Peanuts.....	164	101	16,535	² 38 ⁴ 1.46	421	3,812	⁴ 1.25	522	20,347
Total.....	2,290	1,480	55,682.5	.....	5,020	115,880	.....	6,500	171,562.5

¹ A cooperator conducts a demonstration, but his farm is not regularly visited by the agent.

² Bushels.

³ Poun is seed cotton

⁴ Tons cane hay.

The county agents not only are concerned in the matter of crop production, but are also interested in every other phase of farm activities. During the year the agents made 67,232 visits to farmers, business men, and boys' and girls' club members; traveled 503,014 miles by rail, team, and otherwise. The average time spent in the field represents 75 per cent of the agents' time and 25 per cent was spent in the office answering letters, attending to the regular routine of the office, making out reports, and in personal consultation with farmers and business men. The agents report that during the year they received 85,652 calls at their offices, wrote 41,528 official letters, prepared 2,214 newspaper articles for publication, mailed out 65,652 circular letters and 117,632 bulletins and circulars.

In the boys' club work the agents worked in close cooperation with the county superintendent of schools and teachers. In 352 schools they assisted in outlining the agricultural course of instruction for boys and girls. In many counties they held a short course or extension school for farmers and others interested, securing assistance from the college specialist. Ninety-five such courses were held in various counties, with a total attendance of 32,964. As a result of these ac-

tivities 467 farmers were induced to attend a short course at the college, 218 boys were interested in attending the college, and 69 girls were interested in attending a school for special work in domestic science.

In horticultural work 112 demonstrations were given and field meetings were held, specialists demonstrating the proper methods of pruning and spraying to control insect pests and diseases. A total of 536 orchards, representing 90,593 trees, were inspected, pruned, or sprayed.

A great deal of the agents' time was given to demonstration work in live-stock husbandry, especially where boys' clubs in live stock were organized. This work consisted of educational effort in giving instruction as to the types and utility of the various breeds of live stock, the proper methods of care, and the proper treatment of animals that were affected by diseases. As a direct result of the agents' efforts 98 pure-bred stallions and 51 pure-bred jacks were brought into the State, and 73 demonstrations were given in the proper feeding and care of farm work stock. There was also introduced into the State other pure-bred stock represented by 282 dairy bulls, 1,598 dairy cows, 706 beef-bred bulls, 2,319 beef-bred cows, 1,739 pure-bred hogs, 1,183 pure-bred sheep, and 14,299 grade sheep. Two agents report seven flocks of goats numbering 1,548 head started during the year, 182 new flocks of sheep also were started, 525 new herds of hogs, and 215 beef herds. In the dairy work the agents assisted materially in starting a number of cow-testing associations and instructed farmers in the use of the Babcock tester and the better care of milk and cream.

One hundred and forty-eight new dipping vats were built, in 93 of which the agents prepared and tested the solution used for dipping. It is estimated that, at the present time, there are 686 dipping vats in the State, and 727,769 head of cattle were dipped during the year. Three animal diseases, blackleg and charbon in cattle and cholera in hogs, particularly destructive to the live-stock interest in Oklahoma, have been combated successfully during the past year; 85,750 cattle were treated for blackleg and 4,665 for anthrax; 667 were tested for tuberculosis, and 27,655 were treated for lice and ticks. The single treatment was given for 18,534 hogs and the simultaneous treatment for 90,508. The county agents did not attempt to act as veterinarians in the treatment of these diseases, but only as advisory to the farmers and assisting them in securing the men competent to do this work. The agents report actual treatment by themselves as follows: Blackleg, 30,724; anthrax, 1,700; hog cholera, 2,703. This work was done by the agent only as a demonstration for the purpose of instruction or in the case of emergency to avoid material loss where competent veterinarians could not be secured.

The increased price of farm products resulted in a larger income to the farmers and gave the agents opportunity to suggest many needed farm home improvements. It is impossible to list all of these activities, but as an indication of what has been accomplished it will be noted that with the agents' assistance and advice 2,150 new farm buildings were erected and 1,258 improved, water systems were installed in 115 homes, lighting systems were installed in 487 homes, 1,941 homes were screened against flies and mosquitoes, 638 flytraps were installed, 43 farmers established drainage systems, and 281 farmers were induced to terrace their land covering approximately 13,352 acres. In 19 counties the farmers raised all their own supplies, and in 27 counties they raised 80 per cent of their own supplies. Eighty-seven per cent of the farmers engaged in demonstration work reduced their indebtedness or paid off the mortgages on their farms.

The activities of the agents have also resulted in the development of the peanut industry to such an extent that several peanut-oil mills have been established in the State, giving a ready market for the peanut crop. Cooperative creameries have been established for the benefit of the dairy industry, and several new flour mills and elevators have been built during the year.

The general improvement in agricultural conditions as a result of demonstration work is noted in the increased attendance at schools and churches, better sanitary conditions around the farm homes now provided with lighting and water systems, improved roads, greater number of automobiles used by farmers, better farm buildings, and farms cultivated under a systematic system of rotation and equipped with buildings of better construction and well planned, and also better fences and more live stock.

Boys' club work.—Boys' club work is recognized as one of the most effective educational forces for farm boys in the State. The State course of study for rural schools is being revised by the State board of education with the special purpose of coordinating more effectively with the boys' club work, and the club work will be made a part of the course of study for rural schools. These clubs are one of the most important factors for increasing crop production, rural cooperation, community advancement, and farm improvement. The county agent makes the club work an important part of his duties, the State superintendent of schools has required rural teachers to assist in the organization of boys' and girls' clubs, field meetings and short courses for club members have been attended by both teachers and agents, and plans for very close cooperation are being perfected. The activities of the various clubs are indicated by the names under which they are organized as corn clubs, cotton clubs, wheat clubs, grain-sorghum clubs, peanut clubs, potato clubs, bee clubs, pig clubs, calf clubs, sheep

clubs, and poultry clubs. The above clubs are organized among the white boys, and the negro boys are organized under a separate organization called the farm-makers' club. The total number of members enrolled in the boys' clubs was 13,352 and in the farm makers' club 555.

The boys' club work is under the direction of the State leader, one general club assistant, and one live-stock assistant. All district and county agents devote a part of their time to the organization and supervision of boys' club activities. Instructions are sent to all club members monthly on printed cards which are easily understood. The total value of food crops produced by the boys' clubs is estimated at \$448,600, and it is estimated that more than 5,000 homes have been reached and benefited by the activities of the club agents.

The average acre profit made by the farm-makers' club for negro boys was \$66.86. It is estimated that these negro boys grew food and feed valued at \$22,083.75.

Prize money amounting to \$13,894.98 was distributed among the various clubs, and two short courses were held for prize winners, one at the State fair at Oklahoma City and the other at the agricultural and mechanical college at Stillwater. Short courses were also held in 63 of the 77 counties of the State. Exhibits were made at 59 county fairs and 2 State fairs.

One thousand eight hundred and eighty boys enrolled as members of the pig club, which has been carried on in cooperation with the Bureau of Animal Industry, the specialist in charge conducting his work chiefly through the county agents. There were two classes in the pig-club work, those who raised a sow with a litter of pigs and those who grew a pig and fattened it for market. The average profit of all the members was \$58.81 each. The average cost per pound of gain on the pigs going to market was 7 cents. In one county the boys belonging to the pig club organized a hog-breeders' association, and engaged in the sale of pure-bred hogs which they had grown and which they guaranteed to be pure-bred and of exceptional merit.

The calf-club membership increased to 443. The average profit per member reporting was \$83.54 and the average cost per pound of gain on the calves was 9 cents.

The poultry-club work is available to both boys and girls. This work received a great stimulus this year through the passage of a law by the last legislature intended especially to encourage the poultry industry. This law is mandatory, and names the specialist in charge of poultry extension work at the agricultural and mechanical college as the official to carry out the provisions of the law which provides for the holding of poultry and egg shows in every schoolhouse in the State except those in cities of the first class. Ten dollars of public funds are appropriated for each schoolhouse show.

The law also provided for a county show, for which \$250 is appropriated, and a State show, for which \$2,000 is appropriated. The poultry-club work was made the most important feature of this project. Monthly instructions are sent to all club members, and the various contests were held in school districts in the counties and State as provided in the law.

Home demonstration and girls' club work.—The home demonstration and girls' club work was much more effectively organized than ever before. The call of the United States Food Administration for better organization among women for the conservation of food products found the home-demonstration leader with a very effective organization in good working order. Under the extra stimulus of this campaign the work was being rapidly pushed into newer counties at the close of the fiscal year. During the year 78 home-demonstration clubs were organized, with 1,220 members. The girls' clubs number 255, with an average membership of 15, making a total of 3,815.

Notwithstanding the excessive drought in the western portion of the State, which ruined many of the club members' gardens, on the whole a much larger amount of fruits and vegetables was canned and dried than during any previous year. The activities of the agents engaged in this work consisted in the formation of gardening, canning, poultry, dairy, and better bread clubs. These gave 1,365 public demonstrations in canning, drying, bread making, etc., to 15,481 people.

The women members of the clubs organized under this project put up 270,002 cans of fruits and vegetables, dried 136,929 pounds of fruit and vegetables, and brined 33,634 gallons. The total value of these products is estimated at \$189,162.

In dairy work demonstrations were given in the use of the thermometer to determine the proper churning temperature, also the use of butter workers and churns and better methods of making butter. The home-demonstration agents also interested 2,650 farm homes in the installation of labor-saving devices, such as fireless cookers, iceless refrigerators, flytraps, ironing boards, wheel trays, and water systems.

The poultry work received a great stimulus, due to the passage of the law mentioned above, and 172 club members were interested in purchasing pure-bred birds, and 744 purchased pure-bred eggs.

Rural sanitation.—This work has been conducted as a special project for women under the direction of the State leader and in cooperation with county agents, home-demonstration agents, teachers, and others, and superintendents of schools.

The object of this work is to awaken a desire for better and more sanitary living conditions in farm homes and to give specific in-

struction on these subjects. The work consists chiefly of lectures at schools and meetings arranged by county and home-demonstration agents. During the year the leader addressed teachers of six normal schools twice or more and held 250 meetings with an estimated attendance of 44,955 persons. She traveled by rail 11,128 miles and by automobile 2,540 miles.

At each point where lectures are given an attempt was made to form organizations among school boys and girls to improve the sanitary conditions of their homes by screening the houses, destroying the breeding places of flies and mosquitoes, and making an effort to secure a sufficient supply of pure drinking water. Two thousand and ninety teachers are cooperating with the specialist in this work in some line of sanitary improvement.

Movable schools.—This work was carried on by the assistant director and two assistants, one for farm crops and one specialist in home economics. Other members of the extension force assisted in this work from time to time, also members of the college and experiment station staffs, and in a few cases members of the State board of agriculture assisted. No part of the salary of these people was paid from extension funds, but usually their traveling expenses while doing this work were paid from these funds. The district, county, and women agents always assisted in movable-school work when organized in their respective counties.

In January the use of the term "movable school" was discontinued and the name "community short course" was substituted. Under the plans of this work the school was continued in the county where organized for a period of one week. The county agent was responsible for all the plans and arrangements. One and two day programs were held in each locality.

Marketing and rural organizations.—This work was carried on in cooperation with the Office of Markets and Rural Organization of the United States Department of Agriculture and the State market commission of the State, and has for its object the diffusion of useful information concerning the marketing of farm products. Special efforts have been made to encourage the building of storerooms in town and on the farm for the proper care, preservation, and concentration of farm products either for shipping or local sale. This work was started late in the season, and, while it promises much, no definite results at this time can be given.

Dairying.—The work under this project is conducted in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture. One specialist was employed for the entire year and an assistant from April 1 to the close of the year. A great deal of time was devoted to herd-record work, the organization of cow-testing associations, and the importation into the State of many pure-bred

dairy cattle. The specialist in charge of this work conducted demonstrations at the State fair in which record work, farm butter making, cottage-cheese making, and milk testing were given, and aided in exhibiting various equipment suitable for farmers' use in conducting a sanitary dairy plant. In addition to this work at the State fair, he also conducted demonstrations and judged dairy products at various other local fairs throughout the State. During the year 792 personal visits were made to farmers and 86 meetings attended, at which 20,567 people were present.

OUTLOOK.

The necessity for organized effort to increase the food and feed supply of the country afforded an excellent opportunity to demonstrate to the people the value of the work that was being done and the hearty response these efforts met with on the part of farmers, bankers, commercial clubs, councils of defense, and other organizations gives promise of much greater development in the near future. The drought which prevailed over the western part of the State during the summer afforded an opportunity to render a real service to the farmers in assisting them in planning their work in such a way as to overcome these difficulties in so far as possible and also to conserve and distribute feed, seed, and other necessities to those requiring assistance.

The work thus started will undoubtedly be conducted and developed along progressive lines, and the spirit of friendly cooperation and efficient organization which is being developed forecasts a very successful continuation of the work that has been started.

The demand for county agents at the close of the present year was greater than ever before, and considerable difficulty was experienced in securing qualified men for these positions, especially on account of the fact that opportunity for military service had induced many of the younger and well-trained men to leave the work to join the Army.

The organization of the extension forces in Oklahoma is well balanced, and the plan of the work is constructive.

SOUTH CAROLINA.

Division of Extension, Clemson Agricultural College of South Carolina,
Clemson College.

W. W. Long, *Director.*

Organization and administration.—The general plan of organization is the same as outlined in the previous report. The regular plan for conducting field work proceeded along the usual lines, with special emphasis placed on food and feed production, to meet the emergency caused by the entry of our country into war. Cordial co-

operation was maintained with other agencies in the State as in previous years.

There were a few changes in the personnel of the county-agent force. In all cases where resignations occurred the places were filled by men of superior training and ability.

Publications.—There were published during the fiscal year 9 bulletins, 5 circulars, and 2 posters. The material for the extension publications was furnished by the specialists. Publications were distributed through the county agents and to a select mailing list, kept in the extension office. About 40,000 extension publications were distributed during the year. The Weekly News Notes was issued during the year and mailed to about 1,200 names of farmers, bankers, editors, etc.

Finances.—The following funds were expended for cooperative extension work in agriculture and home economics for the year ending June 30, 1917:

Smith-Lever, Federal-----	\$38, 767. 11
Smith-Lever, State-----	28, 767. 11
United States Department of Agriculture, farmers' co- operative demonstration work-----	44, 478. 56
United States Department of Agriculture, other bureaus-----	15, 651. 70
County appropriations-----	33, 838. 36
College appropriations-----	6, 447. 57
Direct State appropriations-----	2, 614. 89
Other sources-----	7, 881. 90
Total-----	178, 447. 20

Smith-Lever funds were used in support of the following projects: Administration, printing, county agents, home demonstration, negro demonstration work, live stock, dairying, agronomy, horticulture, poultry, marketing, entomology, plant pathology, boys' club work, home demonstration, and mill-village work.

Funds from the United States Department of Agriculture were used in support of the following projects: Administration, county agents, home demonstration, negro work, live stock, dairying, marketing, boys' clubs, mill-village club work for boys, and plant diseases.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—At the beginning of the year 48 county agents were employed in South Carolina. Six of these county agents resigned, which left only 42 agents in the service at the close of the fiscal year. It was not possible to fill these vacancies on account of lack of funds.

Special stress was laid during the year on increased production of food and feed crops and on the production of live stock. The main feature of the work, however, remains the same as in previous years, that of conducting crop demonstrations. The following are some of the results obtained during the year: One thousand and forty demonstrations with corn, average yield of $36\frac{1}{2}$ bushels per acre; 828 demonstrations with cotton, average yield of 1,254 pounds of seed cotton per acre; 41 demonstrations with tobacco, average yield of 910 pounds per acre; 518 demonstrations with oats, average yield of $30\frac{3}{4}$ bushels per acre; 694 demonstrations with wheat, average yield of $15\frac{1}{2}$ bushels per acre; 610 demonstrations with rye, average yield of $12\frac{1}{2}$ bushels per acre; 437 demonstrations with alfalfa, average yield of $2\frac{3}{4}$ tons of cured hay per acre; 318 demonstrations with German millet, average yield of 3 tons of cured hay per acre; 827 demonstrations with crimson clover, average yield of $1\frac{3}{4}$ tons of cured hay per acre; 161 demonstrations with bur clover, used for grazing purposes; 386 demonstrations with oats and vetch for hay, with an average yield of $1\frac{2}{10}$ tons of cured hay per acre; 18 demonstrations with red millet, average yield of 3 tons of cured hay per acre; 827 demonstrations with sweet clover, average yield of 3 tons of cured hay per acre; 12 demonstrations with lespedeza, used for grazing purposes; 11 demonstrations with Sudan grass, average yield of $1\frac{1}{4}$ tons of cured hay per acre; 224 demonstrations with sorghum, average yield of 4 tons of cured hay per acre; 1,710 demonstrations with velvet beans, average yield of $16\frac{1}{2}$ bushels per acre; 313 demonstrations with soy beans, average yield of $17\frac{1}{4}$ bushels per acre; 138 demonstrations with peanuts, average yield of 31 bushels per acre; 668 demonstrations with cowpeas, average yield of $10\frac{3}{10}$ bushels per acre; 349 demonstrations with Irish potatoes, average yield of 129 bushels per acre; 571 demonstration home orchards were established. These orchards were pruned, sprayed, and cultivated under the instruction of the agents.

A very large number of pure-bred live stock was brought into the State through the influence of agents. The summary of this work is as follows: Number of stallions brought in, 3; jacks, 10; dairy bulls, 155; dairy cows, 633; beef bulls, 101; beef cows, 447; number of boars brought in, 311; sows, 1,119; number of flocks of sheep started, 20. The agents have also conducted a large number of demonstrations in the breeding, care, and management of live stock on the farm. The following is a summary of live stock treated for diseases of different kinds throughout the year: Cattle treated for blackleg, 3,046; hogs treated for cholera, 16,970; horses treated for distemper, 43. These animals were treated as demonstrations to give instruction to farmers in diagnosing and handling the above diseases.

Fertilizer demonstrations to the number of 475 were conducted with different crops throughout the year; 3,321 lime demonstrations were conducted. Through the agents' influence, 67 silos have been built; 258 farm buildings have been improved; 241 farm buildings have been painted or whitewashed; 97 home waterworks systems installed; 223 home lighting systems installed; 1,982 homes screened against flies.

The campaign for increased food production resulted in a greatly increased acreage of corn, wheat, soy beans, peanuts, and velvet beans planted during 1917. Also more home gardens were grown and better care was given to them than ever before. More care and attention were given to the home orchard.

Boys' club work.—The boys' club work was organized in every county in the State. It was supervised by the State agent of boys' club work. The field work was performed by the State agent, cooperating with county agents and with school authorities. There were 2,355 boys enrolled in the club activities, as follows: Corn clubs, 1,056; pig clubs, 1,250; calf clubs, 49.

The boys in the corn club produced an average yield of 53 bushels of corn per acre, at an average cost of 40 cents per bushel. The boys in the pig club made an average net profit, for each member in the club making a report, of \$16.35. It is estimated that club members produced food and feed to the value of \$101,972.50.

Clemson college offered scholarships for an agricultural short course of one month to the two club members in each county who made the highest average under the rules. Scholarships were awarded to 76 boys. These scholarships carried with them free board, laundry, and tuition while at the college. Several other short courses for members of the boys' clubs of from one to three days' duration were held in the different counties.

Home-demonstration work.—A woman county agent was employed in each of the 45 counties. There was an enrollment of 7,000 girls making demonstrations in gardening, poultry raising, and bread work; also an enrollment of 13,043 women engaged in home-demonstration work. In addition to the regular enrollment, the work has reached and influenced through public meetings, demonstrations, and circular letters, 25,000 additional women and girls. Following is the enrollment in girls' clubs in 1917: Canning clubs, 3,068; poultry clubs, 1,014; girls making demonstrations in winter gardens, 515; girls making demonstrations in cooking, 1,869; girls taking lessons in bread making, 2,041. Members of the girls' canning clubs put up 734,760 cans and jars of fruits and vegetables. The value of these canned products is estimated at \$161,204.11. In the home-demonstration work there were enrolled 362 farm women in poultry clubs, 5,976 farm women in cooking clubs, and 3,728 women made demon-

strations in winter gardens. Members of the home-demonstration clubs put up 1,573,749 cans and jars of fruits and vegetables from the home gardens and orchards. There were also stored 59,188 pounds of dried fruits and vegetables. It is estimated that at least 1,000,000 cans of fruits and vegetables were put up by farm women who were not enrolled in the home-demonstration clubs as a direct result of the work of the home-demonstration agents.

Another feature of the home-demonstration work was the making of labor-saving devices for the home. Some of the home conveniences made were as follows: Four hundred and fifty-two iceless refrigerators, 63 kitchen cabinets, 52 wheel trays, 69 ironing boards, 18 home water systems installed, 477 houses screened, 29 barrel churns installed. One thousand four hundred and thirty-two clubs were organized among farm women, which met from time to time throughout the year and received instruction from the home-demonstration agents on the subjects of gardening, canning, butter making, cooking, etc.

At the beginning of the year, 37 county agents were engaged in home-demonstration work, and at the end of the year 48.

The home-demonstration agents gave special attention throughout the year to increasing the number of home gardens and the amount of fruits and vegetables canned and dried. The results along this line were very gratifying, and double the amount of fruit and vegetables was put up in the home that has been put up in any previous year. Efforts for increasing the amount of poultry on the farm have also been quite successful.

Negro work.—The demonstration work by negroes was under the supervision of the negro agricultural and mechanical college at Orangeburg. Five negro agents were employed during the fiscal year to work exclusively among negro farmers. These agents worked along the same lines as the white county agents. They also supervised the organization of negro boys and girls into corn clubs, pig clubs, canning clubs, and poultry clubs under the title of Farm Makers' Clubs. These negro agents were active during the year in promoting an increased acreage planted to food and feed crops among negro farmers. The negroes responded to the appeal for growing their home supplies and, as far as possible, carried out this program. In addition to the work done by negro county agents, each of the white men county agents took a proportionate number of negro demonstrators. The negro farmer has shown himself eager and willing to follow the instructions of the extension workers.

Mill-village work.—The specialist in charge of this work, with headquarters at Rock Hill, was under the direction of the director of extension at Clemson college and reported directly to him. The work consisted in organizing mill-village workers to plant gardens, set fruit trees, and keep milk cows and poultry. The report shows

that 2,043 of mill-village workers carried out the instructions given by extension specialists. One thousand four hundred and fifty-two summer gardens were planted; 1,238 winter gardens planted; 416 members grew sweet potatoes; 295 grew Irish potatoes; 705 members set peach trees and grape vines. The mill-village women put up from their home gardens 122,739 quarts of vegetables. Five hundred and fifty-nine cows were placed among mill-village workers. The estimated value of poultry products produced by these workers was \$4,826. The number of meetings held among them was 125, with a total attendance of 15,120. Official letters to the number of 632 were written; 72 demonstrations were given in canning and drying fruits and vegetables; 5 community fairs were held among mill-village workers.

Live stock.—The live-stock work was carried on in cooperation with the Bureau of Animal Industry, United States Department of Agriculture. The specialist in charge is the professor of animal husbandry in Clemson Agricultural College, and he devotes one-fifth of his time to this work. He is assisted by three full-time field specialists. The work under this project has consisted in the erection of silos, planting of pastures, furnishing plans for barns, bringing in pure-bred live stock, and giving instructions in the care and feeding of farm animals. During the fiscal year 41 silos were built under the supervision of extension workers; 96 pure-bred beef bulls, 236 pure-bred cows, and 604 grade heifers were brought into the State for breeding purposes; 51 beef-cattle feeding demonstrations were conducted. The total number of cattle fed under instruction was 1,432. Two packing plants have been erected in the State through the efforts of extension specialists. As a result of these packing plants, the interest in hog raising has greatly increased; 266 new herds of hogs were started during the year through the influence of extension workers. Demonstration pastures for hogs were supervised on 39 farms. Cooperative sales of hogs and cattle have been held in a number of places in the State during the year under the supervision of extension workers. These sales have all been very successful and have brought the farmers an increased price for their live stock.

Dairy husbandry.—This work was carried on in cooperation with the Dairy Division of the Bureau of Animal Industry of the United States Department of Agriculture. Five specialists were employed under this project. Three small creameries have been organized in South Carolina, and these five field specialists have devoted the larger part of their time to the interests of these creameries. The work of the dairy specialist has been along the line of establishing cream routes and assisting the different creameries in the manufacture of high-grade butter, bringing into the State breeding stock, working out balanced rations, instructing dairymen in the proper methods of

feeding, and furnishing plans for the construction of dairy barns, milk houses, and silos. The creamery specialists assisted in the construction of 12 silos, 27 dairy barns, and 13 milk houses. Nineteen one-day dairy schools were held in different communities. The counties of Orangeburg, Florence, and Marlboro have adopted the Guernsey cattle as a uniform breed for the county. Bull clubs were organized throughout each of these counties and high-class individuals were imported to grade up the native herds. The counties of Oconee, Greenville, Spartanburg, and Lawrence adopted the Jersey breed of cattle, and bull associations were organized throughout these counties and pure-bred Jersey bulls imported to grade up the dairy herds of these counties. Seventy-six head of pure-bred dairy cattle were brought into the State during the year through the assistance of the dairy specialists.

Marketing and rural organization.—This work was carried on in cooperation with the Office of Markets and Rural Organization of the United States Department of Agriculture. One specialist was employed to supervise the work under this project. The work has consisted in helping the truck growers of the State in packing, grading, and finding markets for their products. Assistance was rendered to the asparagus, strawberry, potato, cantaloup, and cabbage growers of the State. Truck growers in all sections were assisted and encouraged to organize, build a common packing shed, adopt careful methods of harvesting, grading, and packing, and to cooperate with a reliable selling exchange. Satisfactory results were accomplished.

Agronomy.—There was one full-time specialist in charge of this work, which consisted mainly in carrying on breeding demonstrations with corn and cotton. This work was undertaken because good pedigreed seed corn and cotton seed suitable to local conditions could not be found in the State. The State was divided into 12 districts, and 19 farmers selected to do the work. The breeding work with corn is done by the ear-to-row method, the object being to breed a better yielding variety for each district.

Horticulture.—Two field specialists were employed under this project. The principal work has been an effort to develop the home fruit orchard. Demonstration orchards have been established throughout the State. Lists of trees were made up for these orchards and the planting and care of the orchards was supervised. Through these demonstrations a great interest has been awakened in the home orchard throughout a large part of the State; 225 demonstration home orchards were supervised. During the season of 1917 the horticultural specialists assisted in the campaign for the planting of home gardens. This work was quite successful, and there was a large increase in the number of gardens planted and the care and attention given to them.

Poultry.—One specialist was employed under this project, who devoted part of his time to extension work and part to teaching in the college. The principal work under this project was answering correspondence, attending farmers' meetings, and preparing bulletins and circulars giving instructions on the care and management of poultry.

Entomology.—One field specialist was employed under this project. The work consisted in conducting demonstrations in the control of different insects injurious to farm crops.

Plant pathology.—One field specialist was employed, and his work consisted in conducting demonstrations to show the methods of control of anthracnose, or pink boll rot, in cotton. Field demonstrations were conducted in the different counties in the State in cooperation with county agents. This work was very helpful in demonstrating to the farmers the method of controlling the different diseases of cotton.

OUTLOOK.

At this time there is a strong corps of extension workers. Their efficiency shows steady improvement from year to year. There was, during the past year, more financial cooperation on the part of local communities in paying the salaries of men and women county agents. The results accomplished in the past year were highly satisfactory and the outlook indicates that still more satisfactory results will be accomplished.

TENNESSEE.

Division of Extension, College of Agriculture, University of Tennessee,
Knoxville.

C. A. KEFFER, *Director.*

Organization and administration.—The same general plans and policies outlined in previous reports were followed during 1916-17. As in all other States, the normal conditions under which the work had been progressing were upset by the active entrance of the country into war. It was realized that more strenuous efforts must be made to increase food production. Some of the agricultural plans for the year had to be changed to enable the State to meet the emergency.

From the time of its organization the extension division has sought and received the cooperation of all the agencies interested in the agricultural development of the State. During the year a most cordial working cooperation was maintained with the college of agriculture and the experiment station. Cooperation was maintained with the State department of agriculture, State and county boards of education, chambers of commerce, bankers' organizations, agricul-

tural departments of railroads, county courts, and private citizens. The new war organizations, such as councils of defense and food administration, have channeled their field work largely through the extension organization. The appointment of the dean of the college of agriculture as food administrator for the State made possible real teamwork by the various organizations created for the national defense.

The following are changes in the personnel: H. D. Tate, assistant director, resigned at the close of the fiscal year, and was succeeded by W. A. Schoenfeld. C. E. Brehm became specialist in horticulture, and James Arrentson was appointed specialist in farm implements and machinery. There were the usual changes in the county-agent force. At the beginning of the year there were 57 county agents. During the year 17 resigned and 28 were appointed, making the number in the service at the close of the year 68. The number of women agents was increased from 31 to 47. Two negro women were appointed to work with the negro teachers and the girls and women of the rural districts.

Publications.—Twenty-four publications were issued during the year, aggregating 481,100 copies. These circulars ranged from 2 to 60 pages and treated of timely subjects in a practical, direct style, and were particularly intended for popular distribution. The editor of the division is responsible for the editing, printing, and distribution of all publications. In addition to the regular circulars, numerous circular letters, forms, and reports regarding the work were issued from time to time. The daily and weekly press were furnished news items, written to suit Tennessee conditions. The editors of these publications received the news notes gladly in most cases, and, in addition, frequently contributed editorials along the same line. The specialists and other members of the extension and college forces prepared the subject matter for circulars from data gathered from the investigational and demonstrational results. The publications are distributed through agents from a mailing list kept in the extension office and upon request from interested parties. The classified mailing list is being enlarged.

Finances.—The following funds were expended for the extension work in Tennessee in 1916-17:

Federal, Smith-Lever	\$48,868.52
State, Smith-Lever	38,868.52
United States Department of Agriculture, farmers' co-operative demonstration work	37,610.71
United States Department of Agriculture, other bureaus	15,012.20
County appropriations	48,851.25
Other sources	8,797.51
Total	198,008.71

Smith-Lever funds were used in support of the following projects: Administration, printing, county agents, and boys' clubs, home-demonstration agents, poultry, agronomy, animal husbandry, dairying, marketing, movable schools, hybrid grains, horticulture, beekeeping, dairying, tick-free territory, and cheese making.

United States Department of Agriculture funds were used in the following projects: Administration, county agents, home demonstration, poultry, agronomy, animal husbandry, dairying, and marketing.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—The county-agents' work was extended into 22 new counties this year, making a total of 68 counties covered at the end of the fiscal year. This shows a healthy increase, and it is believed that the system is now sufficiently well established to make it a permanent institution for the State.

Continued efforts were made to establish the work on a community basis. A State-wide campaign for food increase furnished an excellent opportunity to push the community-organization idea. Not only is the demonstration work profiting by this plan, but many communities for the first time were made to realize the benefits coming from cooperative effort. The county agent fully appreciates the community organizations as aids in the many additional duties required of him. The assistance has been especially helpful to agents in promoting the sale of Liberty bonds, Red Cross, and other similar war work.

Activities of the county agents and other extension workers have been broadened to include almost every phase of farm operations and rural development. A very strenuous campaign for increasing the corn production was carried out by the extension forces. This was intended to reach practically all the farmers of the State. There were listed 1,158 corn demonstrations, totaling 14,772 acres, average yield 45 bushels per acre. This is an increase of 16 bushels per acre over the average yield under the ordinary methods of cultivation. It should be understood that the above is only the record of actual demonstrations. In many communities, and, in fact, in whole counties, practically every farmer followed out in some measure the methods advocated by the county agent, which accounted, in large measure, for the crop harvested being the greatest on record.

A striking feature of the year's work was the increasing interest in the production of legumes, such as alfalfa, crimson clover, red clover, and mixed grasses. Soy beans are constantly increasing in popularity as a result of the demonstration work. Increasing interest is noted in home orchards and gardens. The live-stock interest,

through the county agents, working with the specialists in animal husbandry and dairying, has made wonderful strides. Many pure-bred breeding animals were brought in during the year. Cow-testing associations were organized in a number of counties. Excellent work was done by the agents in the campaign for the control of hog cholera.

A few of the most striking results of the demonstration work are as follows: In addition to the corn demonstrations mentioned above, there were 275 demonstrations in cotton, embracing 3,219 acres, which gave an average yield of 690 pounds per acre, or an increase of 301 pounds over the yields on land worked under ordinary methods. There were also 813 cotton cooperators, with 17,000 acres, yielding an average of 524 pounds per acre. There were 150 demonstrations in wheat, with an average yield of 14 bushels per acre; 49 demonstrations in rye, yielding 10.75 bushels per acre; 176 demonstrations in alfalfa, with an average yield of 4.16 tons per acre; 238 demonstrations in crimson clover, with an average yield of 3.87 tons of hay per acre; 151 demonstrations in red clover, with an average yield of 2.8 tons per acre; 439 demonstrations in soy beans, giving an average yield of 17.8 bushels per acre. There were 130 demonstrations in home orchards, embracing a total of 19,876 trees. The agents and specialists assisted in the pruning and spraying of 1,172 orchards, containing 117,079 trees.

The following pure-bred live stock was brought into the State during the year: Twenty-four horses, 510 dairy cattle, 782 pure-bred and 388 grade beef cattle, 841 hogs, 190 pure-bred sheep, and 286 grades. There were 130 poultry demonstrations, aggregating 3,600 birds.

The agents and specialists assisted in the treatment of 2,993 cattle for blackleg and 10,321 hogs were treated for cholera; 6,982 farmers were advised in the use of fertilizers; 952 silos were built; 1,046 farmers were induced to use lime; 220 farmers' organizations were established, with a membership of 3,962; 69 new buildings were erected; 119 farm buildings; 60 plans for buildings furnished; 523 home waterworks systems, and 108 lighting systems installed; 388 houses were screened; 173 new pastures were started; 43 drainage systems were established; stumps were removed on 123 farms; 93 farms were terraced; 1,170 farmers planted cover crops. New machinery sold: One hundred and two binders, 663 mowers, 371 hay-rakes, 97 hay presses, 469 grain drills, 142 ensilage cutters, 198 gas engines, 1,002 disk harrows, 201 section harrows, 132 cream separators, 1,038 two-horse cultivators, 2,614 one-horse cultivators, and 11,531 other small tools.

The agents made 38,975 visits, traveled 246,912 miles, furnished information to 23,360 personal callers, held 3,197 farmers' meetings and

10,027 field meetings, with a total attendance of 247,027 persons, wrote 23,795 official letters, prepared 860 articles for publication, sent out 27,632 circular letters, distributed 68,770 United States Department of Agriculture bulletins and 500,000 college and extension bulletins, visited 1,336 in the interest of club work, held 31 extension schools, with 18,998 in attendance. The short course at the college was attended by 231 farmers. Seventy-five boy and 59 girl club members attended agricultural schools or colleges. Fifty county fairs were held, at which 3,341 demonstrators, cooperators, and club members made exhibits. Sixty farmers are keeping complete cost records and 320 partial records. Improved seed was grown for sale by 770 farmers; 5,137 farmers produced their own sirup; and 2,495 are reported as growing practically all of their home supplies.

The new industries established in the State were: One cheese factory, three creameries, two canning factories, and four lime pulverizers. There were installed in homes 585 labor-saving devices. These figures embrace only part of the things of which there is a record. It is safe to say that several times as many more farms were reached, directly or indirectly.

Club work.—The boys' club work was conducted entirely through the district and county agents. It was originally organized on the individual basis, but during the last two years it has been conducted on the community basis, six boys being the minimum number for a club. Where there were less than six, the members were enrolled as individuals. With the community as a unit, the county agent appoints for each club a supervisory committee, consisting of representative farmers and the teachers of the schools, where the latter will take an interest in the project. This committee assists in measuring the club acres, certifies to the reports, and in other ways assists the county agent. The clubs are organized in the regular form; a constitution and by-laws are adopted and meetings held at stated times through the season. Frequently these meetings are held on the demonstration plats, the president of the club calling them to order, the minutes of the last meeting are read and reports given by all members regarding the progress of the work. These clubs are closely affiliated with the community organizations, where there are such. There were enrolled this year 2,930 corn-club members, 90 pig-club members, and 51 potato-club members.

Home demonstration.—The number of county home-demonstration agents was increased from 31 to 47. The principal activity of the women agents was the organization of girls' and women's clubs. The total membership in girls' clubs was 6,932, and the women's clubs, 5,095. The total number cooperating with these clubs was 18,315. The women agents took a very active part in the campaign for the

increase of food products at the beginning of the war and followed this up by a campaign for conservation. In every county where home-demonstration agents are employed, teachers and housekeepers have volunteered their services as assistants to the county agents, especially in teaching canning and drying of fruits and vegetables. The agents gave special instructions to these volunteers, and through this method were able to reach many more homes than could possibly have been instructed without this cordial cooperation. There was an increase of 22,693 gardens. It is a matter of great satisfaction that the women county agents continued to receive support from local committees and public-spirited women in all the work that is undertaken. The cooperation of the teachers was much more general than at any previous time.

Two negro women were employed as district supervisors. The State department of education, in cooperation with other funds under its control, has employed a number of county rural supervisors for vocational work in the negro schools. These district supervisors have had supervision of the work done by the individual women who enrolled in the various counties. This work has brought gratifying results in the way of furnishing instruction in food preparation, gardening, canning, and other household matters to the negroes.

The specialists in home-demonstration work assisted 20 agents in 115 meetings during the year, giving demonstrations in the preparation of foods and lectures on food values. She has prepared three bulletins on food topics, written many articles for papers, and assisted the department of home economics in various agricultural schools.

The specialist in health and sanitation was in constant demand throughout the State. She delivered many addresses on health topics and was particularly useful in discussing health subjects before schools, parent-teachers' associations, and girls' clubs. She rendered assistance in short-course work, took an active part in the campaign for increasing food production and Red Cross work, and has also prepared three circulars on health subjects.

A summary of the results in home-demonstration work is as follows: Canning-club work was organized in 96 counties. Enrollment: Seven thousand three hundred and forty-three canning, 1,518 poultry, 1,325 winter gardens, 2,184 making cooking demonstrations, 911 carrying bread demonstrations. Number of tin cans of vegetables, 1,602,694; glass jars, 295,378; tin cans of fruit, 375,175; glass jars of fruit, 67,116; peppers, 1,275; bottles of fruit juice, 5,434; glasses of jelly, 1,259; total of all containers, 2,348,336. Total from one-tenth acre, 1,899,347, valued at \$250,955.31. Total from farms and gardens, 448,989, valued at \$176,916.40. Total of all products put up, \$427,871.71.

In the womens' work 32 egg circles and 320 clubs were organized; 969 demonstrated cooking and 915 bread making; 5,199,268 cans and jars of vegetables were put up, valued at \$944,391.90; 3,404,536 pounds of dried fruits and vegetables and 607.195 gallons of brined vegetables were produced. There were installed 263 fireless cookers, 93 iceless refrigerators, 1,558 flytraps, 47 kitchen cabinets, 19 floor mats, 25 wheel trays, 26 ironing boards, 60 water systems, 1,333 houses screened, 225 winter gardens.

Agronomy.—The principal work of the agronomist was teaching the basic principles of crop production and soil management through lectures and meetings, by direct assistance to county agents, and in the preparation of circulars on agronomy subjects. He gave special attention to forage and pasture crops. Through the county agents he continued the distribution of improved strains of barley, soy beans, and peanuts. He also collected a complete list of growers of small grain who had good seed for sale for distribution to growers. Encouragement was given to farmers to devote more attention to improvement of farm crops by seed selection. In cooperation with the Nashville, Chattanooga & St. Louis Railway extension demonstrations in the use of lime on legume crops, begun in 1916, were continued and enlarged. A comprehensive plan for the purchase and distribution of seed wheat by the millers of the State showed that an adequate supply was on hand for the increased production asked for. Special study was given to methods employed by Washington County farmers in growing Tokyo soy beans. A largely increased acreage of these beans was planted as a result of this study. The assistant agronomist devoted his time largely to assisting in the organization of farm-loan associations in cooperation with the county agents, inducing the farmers to make inventories and to keep farm accounts. Farm inventories were made by 650 farmers on forms supplied by the division of extension, and 350 have purchased and are keeping farm account books. A study has been made of farm-leasing systems and also a study has been made of short-time credit conditions as related to farm loans.

Animal husbandry.—Two specialists are employed under this project, which is cooperative with the Bureau of Animal Industry, United States Department of Agriculture. Through the cooperation of these specialists and the county agents, 800 head of pure-bred cattle have been brought into the State during the year. Special stress is placed on the purchase of bulls to be used in grading up the common cattle. The Nashville, Chattanooga & St. Louis Railroad loaned a number of bulls to communities along its lines for the use of the farmers. Such animals have been located in 20 communities, with an increase of 10 during the year. Assistance was given county agents in Haywood, Hardeman, and Anderson Counties in live-stock campaigns

conducted for increasing the purchase of pure-bred bulls. The bankers in these counties assisted by offering loans at reduced rates of interest on long-time notes. Increased assistance was given county and community fairs. Live stock was shown at 24 fairs and shows, and distinct improvement is noted in all animals exhibited. Much greater interest is being taken in the feeding of beef cattle, as is evidenced by the increased number of demonstrations arranged by the county agent. Reports were obtained on 95 breeding demonstrations, with a total of 825 cattle, as against 7 demonstrations last year; 52 pure-bred herds were inspected during the year and the owners advised regarding improvements, sales, etc. In middle Tennessee a sale was held on November 24, at which 53 animals were sold, at an average price of \$234.84 apiece. The specialist helped in the selection and inspection of the animals and in perfecting arrangements for the sale. Another sale was held on March 22, in east Tennessee, where 50 animals were sold at an average of \$172.90 apiece. Similar sales are planned for the coming year. It is gratifying to know the increased interest of the farmers in almost every community in the promotion of this line of work.

Dairying.—This project is carried on in cooperation with the Bureau of Animal Industry, United States Department of Agriculture. Decided progress in this line of work, especially in the way of equipment of farms for conducting dairy work, was noted during the year. An increase of 600 silos was reported through the specialists and county agents, making a total of more than 3,000 in the State. A dairymen's association was organized in middle Tennessee. An effort is being made to affiliate all dairy associations, cream and cheese factories and cow-testing associations with the State association. The legislature passed a bill creating the office of State dairy commissioner. Educational dairy exhibits were made at the State fair at Nashville, the tri-State fair at Memphis, the east Tennessee division fair at Knoxville, and at some of the county fairs. A creamery was opened in Wilson County in August with 28 patrons, and during the first 10 months of its operation these had increased to 105, and the patrons received about 36.6 cents per pound for butter fat. This creamery was established as a direct result of the work of the dairy specialist. Eight cow-testing associations have been established in the State, with a membership of 154. In these associations a record of 3,225 cows was kept. Three cooperative cheese factories have been organized during the year. The Wears Valley factory opened October 23; the Laurel Valley factory and the Trade factory are located in Johnson County. These cheese factories are established in the mountain districts where it is difficult to get ordinary farm-dairy products to market. The specialists continued to furnish upon request of the county agents and dairy farmers throughout the

State bills of material and information on silo construction, dairy barns, milk houses, etc.

Marketing and rural organization.—Work under this project is carried on in cooperation with the Bureau of Markets. The tomato news service was established for the benefit of the tomato growers of the Humboldt and adjoining districts of west Tennessee, by which daily market bulletins were issued to the growers, which proved very beneficial to them in the marketing of their crops. Demonstrations in grading and packing of fruits, icing cars, and other necessary instruction for the proper handling of perishable products were given in various sections, especially in the case of Irish and sweet potatoes, tomatoes, apples, strawberries, and peaches. To facilitate this line of work in the fruit and truck-growing sections, the Nashville, Chattanooga & St. Louis Railway furnished a special car to be run through these important districts. Three or four demonstrations a day were made in grading, packing, and loading the products mentioned. A similar campaign was made for 3 weeks to encourage the proper handling and marketing of poultry, and bee production.

Horticulture.—The horticultural work consisted largely of orchard pruning and spraying demonstrations at meetings arranged by the county agents. Plans for the arrangement of the gardens and orchards were furnished the agents and interested growers. Special bulletins and circular letters were issued on this subject for general distribution.

Poultry.—During the year 117 poultry clubs were organized under the poultry specialist and the county agents, with a total enrollment of 1,443 members. Reports of the club members show a material increase in the size of flocks. In localities where no poultry-club work was done the tendency was to reduce the number. The principal benefits noted from this line of work brought about by improved feeding methods, as advocated by the extension division, and through the recommendation of better houses and the providing of more green food for the flocks. As a result of the special campaign along this line, more than 300 poultry houses were built or remodeled, 17,000 chicks were hatched by poultry-club members, and 10,600 were raised.

Beekeeping.—A beekeeping specialist was employed, but owing to ill health, had to resign after a few months' service. During his brief connection with the division the bee specialist organized beekeepers' associations in five counties, assisted in a bee and poultry campaign, and made personal visits to many beekeepers in 21 counties of the State, giving advice on modern systems of beekeeping.

Movable schools.—Work under this project has taken the place of the old farmers' institutes. Three divisional agricultural meetings are held, at Jackson, Nashville, and Knoxville. These divisional

meetings are held in cooperation with the State department of agriculture. There was a total attendance last year of 7,000, and speakers of reputation took part in each one of these meetings. In addition to the three main meetings, 24 movable schools were held during the year, with an attendance of 3,572. These schools were conducted at the county seats and usually lasted a week. Instruction was given in the form of lectures, field demonstrations, and the judging of farm products and live stock. A car load of equipment was used for demonstration purposes. The equipment consisted of live stock, dairy outfits, horticultural and domestic science outfits, charts, score boards, etc. The campaign for increased food production was carried on under this project. In addition to the regular extension workers, a number of outside speakers were employed to assist in this campaign, whose traveling expenses were paid from funds appropriated to it. Their services were donated, but the expenses were borne by the extension division from the funds allotted to this project.

OTHER EXTENSION WORK.

Farm-machinery specialist.—This project was made possible by the support provided through Mr. George R. James and the Tennessee Implement Machinery Association. The work was begun in February, 1917, and has consisted of a study of various farm engines and implements, such as tractors, pulverizers, corn harvesters, pea and bean tillage machines, and harvesting implements. Fourteen county agents were visited, and with them representative farms were examined in respect to the economic use of farm machinery. This specialist gave assistance and advice in the establishment of water, sewer, and drainage systems on the farms.

OUTLOOK.

Every branch of the extension service in Tennessee worked with increased energy to carry out the State and national agricultural program. All activities for promoting war work have been coordinated into one central organization, working through the extension division. The community-organization idea has grown in strength and usefulness. The administration plans to strengthen lines of work already in operation, and will endeavor to reach every county with at least one agent. The difficulty of securing trained men for agents is the greatest drawback to expansion; but the outlook, on the whole, is very promising.

TEXAS.

Division of Extension, Agricultural and Mechanical College of Texas,
College Station.

CLARENCE OUSLEY, *Director* (on leave); T. O. WALTON, *Acting Director*.

Organization and administration.—The organization of the extension work was continued practically the same as during the previous year, but its activities were greatly increased following the entry of this country into the war and the consequent necessity of greatly increased effort to stimulate increased food and feed production and the conservation of the surplus products of Texas.

Late in the year Hon. Clarence Ousley, director of extension, was called to Washington temporarily to assist the Secretary of Agriculture, and T. O. Walton was made assistant director and State agent, also acting director, during the absence of the director.

The organization at the close of the present fiscal year consisted of the director, assistant director, 2 assistants for men's work, 2 assistants for women's work, 7 district agents, 1 woman district agent, and 137 county agents and specialists. This represents an increase of 21 in the personnel of the department, the additions being 2 district agents, 11 county agents, 4 assistant county agents, 1 local agent (colored), 3 full-time specialists, and a loss of 4 home-demonstration agents.

The extension force is divided into six divisions with a chief at the head of each:

(1) Farm demonstrations which include men and women district and county agents, boys' and girls' club agents, and agents for negroes. This division is under the direct charge of the assistant director and State agent.

(2) Animal-industry division, including specialists engaged in dairying, creamery, and poultry work, hog-cholera prevention, and the organization of boys' beef clubs and pig clubs.

(3) Plant-industry division, including specialists in field crops, horticulture, entomology, and plant diseases.

(4) Rural-economics division, including specialists in farm business organization, farm management, farm engineering, and sanitation.

(5) Rural-economics work and movable schools.

(6) The administrative work of each of these divisions is in charge of a chief who is directly responsible to the director; the specialists in each division are responsible to their respective chiefs and make weekly reports to them concerning their activities. The county agents and home-demonstration agents report weekly on blanks provided for that purpose to the district agents and through them to the

Washington office. District agents and executive assistants are directly responsible to the director of extension. Heretofore the district agents have maintained their residence in their respective districts, but in order to unify the work and obtain the benefits of closer contact with the college it was decided late in the year to require all the district agents to move to headquarters at College Station.

The demand of the Government for young men of energy and ability to serve as officers in the newly organized Army called a large number of the younger men, mostly graduates of agricultural colleges engaged in county-agent work, from their duties to the various training camps in the South, and it was very difficult to fill their places with men well qualified for the position of county agent. In a number of counties also a new plan was adopted of appointing assistant county agents who serve a preliminary training under a well-qualified county agent. This plan was adopted for the purpose of keeping a supply of young men in training who would be available for appointment as county agents, but unfortunately the most of these young men were called into the military service. This plan, however, promises so much that it will be continued, and the number of assistant county agents will be increased as fast as the qualified men are found and the funds available will permit.

The most cordial relations continue to exist between the forces of the college, the experiment station, and the extension division. It is becoming better understood by those in charge of the policy of the educational forces of the State of Texas that the agricultural college and experiment station are the sources of agricultural information, and it is the function of the extension division to carry this information to the rural people. Unfortunately there has been some duplication of work between the extension division and the State department of agriculture. Under authority granted by State law the State department of agriculture is authorized and instructed to conduct farmers' institutes and in connection with this work has organized boys' and girls' clubs and other lines of agricultural extension work which results in a certain amount of confusion in the minds of the people of the State.

During the latter part of the year on account of the excessive drought which extended over the entire western part of the State, necessitating the removal of a large number of cattle from that locality to other regions more abundantly supplied with feed, a market-reporting service was established at Fort Worth under cooperative agreement between the Office of Markets and Rural Organization, Bureau of Animal Industry, the States Relations Service of the Department of Agriculture, and the extension division to facilitate this movement of cattle and other live stock. The movement

was under full headway at the close of the fiscal year, but no definite report was possible at that time.

Publications.—Circulars and bulletins are prepared by the extension specialists, members of the experiment station staff, and heads of the departments in the college, and are published and distributed at such times and in such places as the necessity demands. Leaflets and newspaper articles are prepared by the extension editor, but before publication these are reviewed and approved by the division having such subject matter in charge.

The Farm News is published biweekly and is distributed to the complete mailing list of the division. This is a small four-page leaflet containing timely information relative to agricultural matters. All newspapers of the State are furnished weekly press letters containing matters suitable for publication in their respective papers. No plate matter is sent out.

During the fiscal year printed matter was published as follows: Bulletins, 71,500 copies, 1,584,000 pages; circulars, 154,510 copies, 258,830 pages; leaflets, 208,520 copies, 208,520 pages; Farm News, 201,000 copies, 804,000 pages; total, 635,530 copies.

Finances.—The following funds were expended for cooperative extension work in agriculture and home economics for the year ending June 30, 1917:

United States Department of Agriculture, farmers' cooperative demonstration work.....	\$66,686.63
United States Department of Agriculture, other bureaus.....	7,315.76
Federal Smith-Lever.....	75,940.22
State Smith-Lever.....	65,940.22
County appropriations	90,254.67
Total	306,137.50

Smith-Lever funds were used in support of the following projects: Administration, printing, county agents, home-demonstration work, rural women's clubs, movable schools, boys' clubs, negro work, plant industry, creamery, dairying, animal industry, and rural economics. United States Department of Agriculture funds were used in the following projects: Administration, county agents, home-demonstration work, boys' clubs, creamery, and dairying.

SMITH-LEVER PROJECTS.

County agents.—Material progress was made during the year under the leadership of the assistant director and State agent, assisted by seven district agents. At the close of the year there were 96 county agents. The value of the work of the county agent is being more generally recognized by the counties, and they are insisting on the services of men trained along agricultural lines. Where the work of the county agent has been well organized and efficiently

carried out, little difficulty has been experienced in securing local cooperation except in those counties in the western part of the State which have been seriously affected by drought during the past two years. Thirty-five additional counties made appropriations for the establishment of the work during this year, and only three counties withdrew their financial support. County agents have been encouraged to work through local community organizations, and many of the counties of the State are thoroughly organized. Where farmers' organizations are already in existence no effort is made to form new and competitive associations, but the agent is instructed rather to work in cooperation with the established farmers' organizations wherever cooperation can be secured.

The vast amount of extra work required of the county agent this year in assisting the Government in obtaining information of importance relative to organizing its forces for the prosecution of the war has seriously interfered with the regular work on which the activities of the agent are normally focused. Notwithstanding this added burden, however, material progress has been made and attention is called to the detailed table, showing the number of demonstrations with various crops and the result obtained:

Some results of field-crop demonstrations in 1917.

Kind of crop.	Number of demonstrations.	Number of demonstrators reporting.	Total acreage.	Average yield per acre.	Number of co-operators.	Total acreage co-operators.	Total.	
							Demonstrations.	Acres.
Maize.....	86	62	186	84 bushels.....	85	1,491	147	1,677
Peteria.....	21	21	366	72 bushels.....	190	516	211	882
Kafir.....	62	36	2,490				38	2,490
Corn.....	1,767	1,017	16,211	26 bushels.....	8,323	26,749	9,340	42,960
Cotton ¹	988	608	17,605	813 pounds.....	8,073	40,637	8,681	58,242
Oats ²	285	184	9,465	28 bushels.....	499	3,144	683	12,609
Wheat ²	281	189	1,918	23 bushels.....	499	12,090	679	14,008
Barley ²	27	14	293	38 bushels.....	11	160	25	453
Rice ²	15	4	3,004	77 bushels.....	1	600	5	3,604
Rye ²	42	27	151½	32 bushels.....			27	151½
Alfalfa ³	54	22	804	3 tons.....	57	797	79	1,601
Cane (hay) ³	81	30	487	2½ tons.....	343	1,993	373	2,480
Sorghum ³	78	52	3,018	3½ tons.....	53	426	105	3,444
Sudan grass ³	140	85	2,250	3½ tons.....	345	5,524	430	7,774
Meadow and pasture.....	13	11	61	2½ tons.....	11	63	22	124
Millet ³	17	5	292	3½ tons.....			5	292
Clover ³	88	41	90	1 ton.....	10	20	51	110
Soy beans ^{4,5}	135	102	1,569	21½ tons.....	1,498	6,705	747	8,274
Peanuts ^{4,5}	494	291	6,354	24½ bushels.....				
				1½ tons.....				
Cowpeas ^{4,5}	321	177	7,421	18½ bushels.....	1,238	8,192	1,415	15,613
				2½ tons.....				
Field peas ⁴	39	39	10,027	8½ bushels.....	200		239	10,027
Velvet bean ⁴	107	42	458	15½ bushels.....	202	1,165	244	1,623
Mexican beans ⁴	18	6	250	12 bushels.....			6	250
Spanish peanut.....	12	7	125	29.5 bushels.....			7	125
			84,894			122,868		207,763½

¹Seed cotton.

²Small grain.

³Hay, forage or clover.

⁴Seed bushel.

⁵Cured hay.

It will be noted that a considerable number of demonstrators who started out in the spring failed to report on their work in the fall. Under normal conditions this is always unavoidable, but it was augmented because of the excessive, persistent drought which prevailed over the western part of the State, in many instances being so severe that absolutely no crops whatever were produced, and many farmers were compelled to dispose of their live stock. Notwithstanding these conditions, the average results in crop yield obtained by those demonstrators reporting will be seen to be very much above that of the State average reported by the Bureau of Crop Estimates.

The efforts of county agents have influenced farmers to select better seed, to care for it, test it carefully, and plant it on land prepared in the proper season. Results from fall-plowing demonstrations have indicated the great advantage of this practice, and all demonstrators are encouraged to prepare their land very early in the season. Reports show that 11,303 farmers were influenced to select their seed corn (including Kafir, milo, and feterita) for next year's crop, and 78,516 bushels of seed were selected according to the agents' direction; 1,322 demonstrators fall plowed their demonstration plats; 573 demonstrators planted a fall cover crop, which they turned under later; 3,338 harvested crops for silage; 1,692 were influenced to select carefully in the field their cotton seed for next year's crop; 773 prepared their demonstration acres in the fall; and 102 sowed the cover crop on the land to be planted in cotton. The acreage of small grain was largely increased through the active campaign of agents, who induced banks and other organizations to provide large quantities of selected seed, which was furnished the farmers at cost. Much of the small seed thus secured had been grown on demonstration fields under the supervision of county agents. Demonstrations in the production and proper utilization of hay, forage, and cover crops were conducted on 471 farms, with 246 reporting, the average yield being approximately 3 tons per acre; 823 acres were grazed off as pasture demonstrations; 212 acres of legumes in this class of crops were inoculated under the direction of county agents. The acreage of peanuts, cowpeas, velvet beans, and soy beans was greatly increased in all the counties, but especially in east Texas. County agents report a total of 178,515 acres of these crops in their counties directly due to their efforts and influence, 12,734 of these were thrashed for seed and 10,728 acres cut for hay; 27,250 were grazed off at an estimated average value for grazing of \$25.23 per acre; 7,289 acres were turned under for soil improvement; and 124 acres were inoculated under the direction of the county agent.

Sweet potatoes were grown by 273 demonstrators, 112 of them reporting a total of 1,234 acres, with an average of $273\frac{2}{3}$ bushels per acre; 400 acres were treated for diseases; and 29 demonstrators re-

ported a total acreage of $154\frac{1}{2}$ acres of Irish potatoes, yielding an average of 159 bushels per acre.

Two hundred and eight demonstration home orchards, containing 32,833 trees, were managed under the direction of the county agents and extension specialists; in addition to this 840 orchards were inspected and suggestions made concerning matters for their improvement.

Special efforts have been made to assist the small farmer to give his attention to the live-stock industry, and these efforts have met with success, especially in east Texas. Thirty-six pure-bred stallions, 30 pure-bred jacks, and 2,741 brood mares were located in different sections of the State through the agents' influence; 47 demonstrations in feeding horses and 115 in feeding mules were given; 292 pure-bred dairy bulls, 1,789 pure-bred dairy cows or heifers, and 2,477 grade dairy cows were brought into this section of the State, due to the influence of the county agent; 2,492 farmers were induced to study better methods of feeding, and 196 demonstrations in dairy work were supervised with 3,568 demonstrations; two creameries, 32 cream routes, 8 cow-testing associations, and 44 dairy breeders' associations were established; 284 pure-bred beef breed bulls, 2,066 pure-bred beef cows or heifers, and 4,149 grade cows of the beef type were placed in various parts of the State; 106 breeding herds of beef cattle were started and 35 feeding demonstrations were conducted with a total of 7,389 cattle in the demonstration; 7 cattle breeders' associations or clubs were formed, with a membership of 239. Eight hundred cattle-dipping vats were built through the influence of the county agents, and 2,791 are being constructed under their supervision. The dipping solution was tested in 755 different vats, and 925,602 cattle were dipped for tick during the year.

Through the county agents' influence 4,694 pure-bred hogs and 391 pure-bred sheep were distributed among the farmers, and 1,652 farmers have been induced to start growing grazing crops for their hogs and sheep.

Demonstration agents and other extension workers also have induced farmers to take better care of their animals and treat them for diseases. The number which have come under the observation of county agents are, for blackleg, 82,619; ticks, 186,630; lice, 6,938; hog cholera, single treatment, 30,121; simultaneous treatment, 20,716; hogs treated for worms, 4,869; for lice, 6,938; for mange, 16,870; sheep treated for worms, 55; for scabies, 327; and ticks, 1,168.

During the year county agents made 94,630 visits to demonstrators, cooperators, other farmers, and business men, traveling 650,035 miles by rail, team, and otherwise. They received 57,297 visits at their respective offices, attended 5,041 farmers' meetings, with a total attendance of 441,109. They held 1,528 field meetings, with a total attend-

ance of 17,770; they wrote 46,560 official letters, 3,918 articles for local newspapers, and sent out to farmers of their counties 141,507 circular letters, 80,237 United States Department of Agriculture bulletins, and 73,543 State, college, or experiment station bulletins.

Boys' club work.—The boys' club work is supervised by a State boys' agricultural agent and a special State pig-club agent, who is paid by the Bureau of Animal Industry under cooperative agreement. The field work was performed by these two agents and the county agents cooperating with local school authorities, bankers, and other business men.

The total club enrollment for this year was 12,869, divided as follows: Corn clubs, 3,513; cotton clubs, 1,339; peanut clubs, 1,433; grain-sorghum clubs, 800; pig clubs, 5,115; and baby-beef clubs, 569. This is a gain in total enrollment over last year of 3,738. The average yield of the 10 highest records in corn was 74.19 bushels per acre, grown at an average cost of 27 cents per bushel. The average yield of the 10 highest records in grain sorghums was 36.3 bushels per acre, at an average cost of 24 cents per bushel. The average yield of the 10 highest records in cotton was 1,572.7 pounds of seed cotton per acre, at an average cost of 3 cents per pound for the seed cotton. The average initial weight of 3 of the highest baby beeves was 202.6 pounds, the average final weight 544 pounds, the average net profit in feeding \$36.54 per animal.

With the financial assistance of bankers, a large number of boys and girls were furnished pure-bred pigs, and one of the most important lines of work accomplished this year was the locating of well-bred sows from the Fort Worth stockyards in east and southeast Texas counties, where there was an excellent feed crop. These hogs had been shipped from the drought-stricken sections of Texas to the markets at Fort Worth. They were selected there by the pig-club specialist, immunized against hog cholera, and shipped in carload lots to the various counties, where they were distributed to boys who had made arrangements for financial assistance with the local banks whenever necessary.

State exhibits and contests of club members were held at the State fair, at Dallas, at the Cotton Palace, Waco, and the Texas boys also participated in the interstate club contest at the Oklahoma State fair, the Louisiana State fair, and the Southern Live-Stock Exposition at New Orleans. Twelve local county encampment schools of from two to five days' duration, one State encampment school at the Dallas State fair, and one short-course school at the State agricultural college were held during the year, with an approximate total attendance of 1,050 club boys. The average attendance at the local county encampments was about 40 club boys, and there was also a very good attendance, during the day meeting, of parents and other people in-

terested. At the State encampment at Dallas 410 people were present, and the club boys were formed into a military organization consisting of two battalions or four companies each. Each company was under the direct supervision of the captain, the assistant State agents being used for captains. During the farmers' short course in July 169 club boys were assembled at the college, a special program of instruction being arranged for them.

Home demonstration and girls' club work.—Home-demonstration work has been conducted in 30 counties. The total enrollment of these clubs this year was 6,593, as compared with 4,575 last year. The work is divided into three branches—home-demonstration, canning clubs, and poultry clubs. In the home-demonstration work, 1,725 women were enrolled, of whom 1,112 did active work. There were 152 organized clubs, 80 of these holding regular meetings. Members of the home-demonstration clubs put up 585,824 cans of fruits and vegetables, dried 112,880 pounds of fruits, and put up 4,505 gallons brined vegetables. Winter gardens were made by 146 women, 432 were instructed in butter making, and 160 were instructed in bread making. Four county rest rooms were established in county seats and placed in charge of the county home-demonstration agent. These rest rooms were equipped with conveniences for the comfort of farm women, and usually had demonstration kitchens in connection with them.

The enrollment in the girls' canning-club work was 3,118, over one-half of whom made complete reports of their work. Club girls raised 752,385 pounds of tomatoes and 92,157 pounds of beans on one-tenth acre plats. From the one-tenth acre plats 83,077 cans of tomatoes, 28,488 jars of tomatoes, and 49,922 cans of other vegetables were put up, while 66,479 jars of additional miscellaneous products were put up by club girls. The total estimated value of products put up by club girls is \$58,277.24; total number of girls making towels, aprons, and laundry bags is 1,619; making caps, 1,898, and making uniform dresses, 981.

Boys' and girls' poultry clubs enrolled 875 members of whom 600 qualified as to the requirements in number of eggs set and chickens raised. Of these club members, 187 took entire charge of the farm flocks of poultry; 347 purchased pure-bred eggs, 64 purchased pure-bred birds, and 64 made brooders in accordance with plans furnished by the home-demonstration agent.

At the outbreak of the war during the early summer, young ladies from the University of Texas, College of Industrial Arts, and the various normal schools of Texas, volunteered their services in the emergency food campaign. Organizations were perfected under the auspices of the State leader of home-demonstration work, and 371 volunteer demonstrators served through the canning season. As a

direct result of their campaign 2,470,000 containers of food were saved and 5,420 people were influenced directly to conserve food. The young women who volunteered for this service served without pay, and deserve the highest prize for their patriotic zeal.

Club rallies and exhibits were held in all the counties where there was an active organization. A short course was given at the State agricultural college during the season of the Texas farmers' congress in July, and an encampment of a large number of club girls was held at the State fair at Dallas in October. The privilege of attending this encampment was granted on a competitive basis. This encampment was under the direct charge of the State leader and her assistants, and the State fair association furnished dormitory and equipment necessary to take care of them properly. It also furnished meals free and free tickets to the fair.

Negro work.—This work is under the farm-demonstration division, and is carried on by two negro men who work entirely with negro men and boys, and two negro women trained in domestic science to give their entire time to the instruction of negro women and girls.

The plan of the negro work is to teach by actual demonstration successful methods both in the home and in the field. Special work emphasized for these people has been the growing of food and feed crops and the conservation of the same. Special emphasis has been placed on the growing of corn among the men and better gardening among the women, together with instructions and demonstrations in canning, drying, and pickling of vegetables and fruits. Fifty demonstrations were conducted by negro farmers under the supervision of negro agents and visited regularly by them. The negro women agents organized and instructed 65 negro women and girls' organizations numbering over 1,000 club members.

Animal industry.—This work is carried on by a leader, two assistants, and three specialists working under cooperative agreement with the Bureau of Animal Industry of the United States Department of Agriculture, in charge of boys' pig-club work, creamery work, and dairying. The work is carried on in close cooperation with the county agents, giving practical demonstrations in feeding and breeding farm animals, organizing breeders' associations, cow-testing associations, pig clubs, poultry clubs, and also giving considerable attention to the transportation of live stock from the drought-stricken regions of the western part of the State to those parts of east and southeast Texas having an abundance of feed and adapted to the various phases of the live-stock industry. This work was inaugurated during the latter part of the fiscal year and an office was maintained in Fort Worth, but the work was not

complete at the close of the fiscal year and definite results can not be given at the present time.

One specialist in charge of dairy work and one in charge of creamery work devoted their entire time to giving instruction to organized clubs of farmers in better methods of sanitary dairying, proper development of the dairy industry in those localities where it is likely to be successful, the organization of creameries, and the standardization of the products of creameries already established.

Plant industry.—This work is under the direction of a leader assisted by six specialists in charge of agronomy, plant pathology, entomology, horticulture, agricultural engineering, and pecan improvement.

In order better to correlate the plant-industry work being carried on at the college, a "plant-industry council" was formed that meets monthly with the extension division. At this meeting the specialists engaged in the work of plant industry in the extension division, the experiment station, and the college instructors, discuss questions of importance in their respective fields of work, and decide upon definite policies to be followed. This has done much to harmonize the three separate divisions engaged in this work, and insures unity of effort and avoids duplication.

One special line of work in seed-corn improvement was started, and on account of the drought conditions in various parts of the State and the failure of many farmers to produce their seed corn, this branch of the work developed this year into a very important feature, and the specialist in charge of this work was commissioned by the United States Department of Agriculture to carry out the provisions of a special enactment of Congress authorizing the purchase of a large amount of seed corn to be held in storage, tested, and resold to farmers at actual cost.

The specialist in charge of agricultural engineering devoted most of his time to giving instructions and demonstrations in proper methods of terracing land to prevent its damage by soil washing, and also to conserve the storm waters in regions of limited rainfall so that the water may be retained on the land for the benefit of the crop. In numerous instances in west Texas fields given over to these terracing demonstrations produced average crops of corn and cotton where fields similarly situated but not terraced produced no crop at all. All county agents have been instructed in the use of the level in terracing work and they in turn have been able to instruct many of their demonstrators and cooperators and have encouraged the purchase of levels among the farmers of their respective counties. In many instances these levels are purchased by the county commissioners' court and are loaned to farmers in the county for a

limited length of time. Where this work has been inaugurated the demand for these levels keeps them in practically constant use.

Rural economies.—The object of this work is to give instruction to county agents, farmers, and business men's organizations relative to effective plans and methods of organization for the promotion of a more diversified system of agriculture and the better marketing and grading of farm products. The work was conducted by a leader and six assistants who were specialists in this line of work. Definite results were noted in three special lines of work—the proper handling, storing, and marketing of sweet potatoes, the proper grading and marketing of cotton, and a market-news service with reference to the movement of cattle and feed between different sections of the State, and also on interstate shipments. The latter work was started during the summer and was in active operation at the close of the fiscal year. Much good work had been accomplished and the results were apparent, but as the work was continuing no definite report can be made as to the actual results. This will naturally appear in the report for the next fiscal year.

OUTLOOK.

At the close of the present fiscal year the extension forces in Texas were better organized than ever before. This was undoubtedly due to the very active campaign for increased food and feed production inaugurated by the United States Department of Agriculture in cooperation with the State forces and the apparent necessity of utilizing every agency possible to further this work. The one idea uppermost in the minds of all of the workers was to do the most efficient service possible in their respective lines of endeavor, and the spirit of cooperation manifested is commendable. The legislature has indicated a desire to assist the work by permitting counties to increase their appropriation for home-demonstration work to \$1,500 per annum, which is \$500 more than they are permitted to appropriate for the men's work. This is evidence of the favor with which their work has been received by the people of Texas.

VIRGINIA.

Division of Extension, Virginia Agricultural and Mechanical College and Polytechnic Institute, Blacksburg.

JESSE M. JONES, *Director*.

Organization and administration.—The year began with a very important change in the organization of the extension division. President J. D. Eggleston, who had been acting director for some time, was relieved of this duty by the selection of Jesse M. Jones as

director. The policy of the director has been to bring as many as possible of the State leaders in extension work to the college at Blacksburg. There were no important changes other than these in the plans of the work during the year, neither was there any change in the method of procedure.

The extension forces of the State consist of the director, a State agent in charge of men's work, a State agent in charge of women's work, 3 district agents in men's work, an assistant State agent in charge of boys' clubs, 2 district agents in women's work, 1 home-economics specialist, 1 district agent in charge of negro men's work, 1 district agent in charge of negro women's work, 4 full-time specialists, 3 part-time specialists, 49 county farm-demonstration agents, 3 assistant county farm-demonstration agents, 41 county home-demonstration agents, 15 assistant home-demonstration agents, 17 negro county farm agents, and 35 part-time county agents in negro women's work. These figures show an increase in employees all along the line over the preceding year. The increase is especially marked in the case of the women county agents, of which the number is almost double that of the preceding year. The State agent in charge of men's work continues to have his headquarters at Burkeville. The State agent in charge of women's work moved her headquarters to Blacksburg. All district agents still have headquarters in the field. The boys' club agents and all specialists have headquarters at Blacksburg. The extension division is a definite department of the college holding the same relative position as the experiment station and the department of agricultural instruction.

There is every evidence that the relations of the extension division with the other departments of the institution are cordial. There is no written memorandum of understanding between the extension division and the State department of agriculture, but friendly relations obtain and much work is done in cooperation. An informal agreement with the State department of public instruction exists bearing particularly upon the negro home-makers' club work, which is carried on to a considerable extent by negro women school supervisors. These women devote nine months of the year to the supervision of industrial work in negro schools and three months to club work with women and girls. The names of these women appear on the pay rolls of the extension division during the months of July, August, and September. The Hampton Normal and Agricultural Institute, the land-grant college for the negroes of the State, is actively cooperative in the support and direction of negro extension work. The negro district agents make their headquarters at this institution. The extension division has the hearty support and cooperation of such organizations as the State farmers' institute, State horticultural society, and other volunteer agricultural organizations.

After war was declared the governor appointed a State council of defense and named as members of this council the director of extension and State agent in charge of women's work. These members of the State council of defense have been charged with the direction of all agricultural and home-life problems relating to production and conservation of food. County councils of defense were formed and in all cases where there were county agents they were given places as members of this council. Through such a plan a strong organization is being developed that not only promises to give valuable support to the extension forces during the period of the war, but may be continued as a permanent organization to support the work in the State after the close of the war.

No library for the extension division is maintained. Books of especial value to extension workers are provided with extension funds and placed in the college library. This library is available to all extension workers.

During the first two or three months of the year the extension division occupied rooms in the Y. M. C. A. Building. From September 15 to January 1 the division occupied quarters in the basement of the agricultural hall. After January 1 quarters were taken up in a building on the campus consisting of seven rooms and a basement. Twenty-one extension employees have offices in this building.

Publications.—During the year six bulletins, with 68 pages and 46,000 copies, 2,000 vegetable charts, 15,000 posters, and 10,000 food-conservation cards, were issued. Beginning with January 1 a News Letter has been issued every month, giving important extension news items, activities of county agents and specialists, instructional articles, and other matters that need to be called to the attention of those engaged in extension work. All publications and literature are distributed through regular mailing lists, specialists, and county agents. News articles giving information on agricultural and home economics activities of the extension division are prepared every week for the daily and weekly newspapers of the State. The editor of the extension division has general charge of the preparation and distribution of these articles.

Finances.—The resources of the extension division for the fiscal year ending June 30, 1917, were:

United States Department of Agriculture, farmers' co-operative demonstration work.....	\$37,031.01
Smith-Lever, Federal.....	45,331.93
State Smith-Lever.....	35,331.93
United States Department of Agriculture, other bureaus.....	2,396.84
State appropriation.....	2,168.07
County appropriation and other sources.....	33,601.74
Other funds.....	9,122.00
Total.....	164,983.52

Smith-Lever funds were used in support of the following projects: Administration, printing and distribution of publications, county agents, home-demonstration work, cheese making, animal husbandry, horticulture, dairying, poultry clubs, drainage, negro women and girls, negro men and boys, movable schools, and boys' clubs. United States Department of Agriculture funds were used in support of the following projects: Administration, county agents, home-demonstration work, cheese making, poultry, negro women and girls', negro men and boys', and boys' clubs.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—The work was carried on in 49 counties of the State with increasingly satisfactory results. The personnel of the agents' force is being gradually improved through the securing of better-trained men. Most of the untrained men who were formerly employed have retired voluntarily from the work and their places have been filled by trained men. As was true in all the States, the county agents rendered heroic service in emergency problems that arose following the entrance of this country into the world war. Too much can not be said in praise of the devoted efforts put forth by the county agents to meet the emergency problems that arose incident to the war. The following is a summary of the activities of the county agents:

White: The agents made 48,579 farm visits; traveled 306,918 miles; answered 23,687 calls; held 2,559 meetings; addressed 2,357 meetings with a total attendance of 103,572; held 758 field meetings with an attendance of 3,444; wrote 34,310 letters; prepared for publication 1,355 articles; prepared 31,963 circulars; distributed 29,464 United States Department of Agriculture bulletins; distributed 17,631 State college bulletins and circulars; made 2,142 visits to schools; assisted 163 schools in outlining courses in agriculture; assisted in 13 extension schools, or short courses, with an attendance of 3,200; assisted in organizing 209 farmers' clubs, with a total membership of 11,842; erected 207 buildings, improved 287, furnished plans for 157, painted or whitewashed 483; installed water systems in 122 homes; installed 55 home-lighting systems; improved sanitary conditions in 1,528 homes; screened 1,491 houses; installed 285 flytraps; erected 1,601 sanitary privies; induced 1,302 farmers to adopt systematic rotation; established 418 new pastures; 109 drainage systems; started or improved 3,579 home orchards; influenced 8,128 farmers to save surplus products for winter use; induced 4,572 farmers to plant winter cover crops; advised 16,035 farmers regarding the proper use of fertilizer; conducted 3,890 fertilizer demonstrations; influenced 1,149 communities to buy fertilizer cooperatively, value of fertilizer bought co-

operatively \$213,115, amount saved, \$21,834; induced 3,797 farmers to take better care of manure; built 853 silos; influenced the building of 490 additional silos; influenced 5,358 farmers to use lime; influenced the installation of 28 lime crushers and the building of 151 lime kilns; conducted 383 demonstrations with home orchards, with a total of 25,395 trees; influenced the pruning of 1,139 orchards and spraying of 630; established 185 orchards with 11,991 trees; assisted in caring for 57 commercial orchards. The total number of trees in all orchards under the supervision of county agents was 178,808.

The following table gives some results of field-crop demonstrations for 1917:

Some results of field-crop demonstrations in Virginia in 1917.

Crop.	Demonstrators.				Cooperators.			Demonstrations.	Acreage.
	Number.	Reporting.	Acreage.	Average yield per acre.	Number.	Acreage.	Average yield per acre.		
Corn.....	681	508	14, 274	56.4 bushels...	2, 393	21, 574	34.7.....	2, 901	35, 848
Cotton.....	65	37	361	.....	30	252	700 pounds....	67	613
Tobacco.....	38	14	110	1.297 pounds....	.....	.....	.....	14	110
Wheat.....	569	213	8, 591	21.8 bushels...	1, 587	10, 997	18 bushels.....	1, 800	19, 588
Rye.....	258	91	3, 570	.....	220	2, 733	16 bushels.....	311	6, 303
Oats.....	76	28	2, 296	37.9 bushels.....	388	3, 079	34 bushels.....	416	5, 375
Alfalfa.....	1, 092	442	8, 023	3.6 tons.....	420	1, 533	.....	862	9, 556
Crimson clover.....	313	198	3, 080	1.2 tons.....	322	3, 335	.....	520	6, 415
Mixed grasses.....	751	261	17, 275	2.78 tons.....	1, 452	8, 424	1.6 tons.....	1, 713	25, 699
Sweet clover.....	38	13	216	1.8 tons.....	5	12	.....	18	228
Soy beans.....	444	194	2, 664	14.5 bushels...	267	1, 874	9 bushels or 1.3 tons.....	461	4, 538
Cowpeas.....	589	211	3, 946	17.5 bushels or 2.75 tons.....	1, 052	3, 132	1.9 tons.....	1, 263	7, 078
Velvet beans.....	50	29	112	10 bushels or 3 tons.....	15	60	6 bushels or 1 ton.....	44	172
Peanuts.....	74	36	1, 243	52.7 bushels...	169	2, 020	41.6 bushels...	205	3, 263
Potatoes.....	460	195	1, 416	269 bushels....	.....	.....	.....	195	1, 416
Total.....	5, 798	2, 470	67, 177	.....	8, 320	59, 025	.....	10, 790	126, 202

Live-stock demonstrations were held as follows: Feeding horses or mules, 21; dairy cattle, 39; beef cattle, 118; hogs, 103; sheep, 12; poultry, 458. Through the influence of county agents 35 pure-bred horses were brought into the State, 640 pure-bred dairy cattle, 897 grade breeding stock, 534 pure-bred beef cattle, and 388 grade breeding stock, 883 pure-bred hogs, 183 pure-bred sheep, and 1,464 grade breeding sheep. Seven cheese factories have been established during the year, 91 beef breeding herds started, 323 herds of cows, 139 flocks of sheep; poultry management has been improved on 658 farms, 2,407 cattle have been treated for blackleg, 22,897 hogs for cholera, and 107 horses for various diseases.

Negroes: Work was carried on by 17 agents in as many counties. The district agent gave some assistance in 13 additional counties, making a total of 30 counties reached by the negro farm-demonstration work and a total of 20,819 negro farmers reached by extension work during the year. The call to the negro farmers for increased production and conservation of food and feed met a hearty response,

and more food and feed were produced and saved during the year 1917 than ever before, notwithstanding the shortage of labor and unfavorable climatic conditions.

The following is a summary of the activities of the county agents: Visits to farms, 10,748; miles traveled, 64,835; calls on agents, 551; farmers' meetings held, 679; addresses delivered, 910, with an attendance of 112,979; field meetings, 257, with an attendance of 1,753; 24 per cent of the agents' time was spent in the office and 76 per cent in the field; letters written, 5,311; circulars prepared and sent out, 3,017; United States Department of Agriculture bulletins distributed, 33,251; State college bulletins or circulars distributed, 3,002; visits to schools, 278; exhibits were made at 17 county fairs; county agents have assisted in organizing 181 farmers' clubs, with a membership of 2,728; conducted demonstrations in 304 home orchards; instructed and influenced the spraying and pruning of 895 orchards; influenced the planting of 27 orchards; advised 2,381 farmers regarding the use of fertilizers; bought 249 tons of fertilizer cooperatively, valued at \$7,072, with a saving of \$1,500; induced 10,618 farmers to take better care of farm manure; built one silo; induced 1,187 farmers to use lime; 162 buildings have been erected, 341 improved, 859 painted or whitewashed; 7 water systems and 2 lighting systems were installed; 899 home grounds improved; sanitary conditions on 1,857 farms improved; 1,331 homes screened against flies and mosquitoes; 97 fly traps installed; 206 sanitary outhouses erected; 134 pastures established; 26 drainage systems established; 4,154 home orchards planted or improved; and 1,389 farmers planted winter cover crops. Among demonstrators and cooperators 4,409 raised home supplies, 969 opened bank accounts, 6,434 own their farms, and 1,756 trade on a cash basis.

The following gives some results of field-crop demonstrations for negroes in 1917:

Some results of field-crop demonstrations in Virginia in 1917.

Crop.	Demonstrators.				Cooperators.			Demonstrations.	Acreage.
	Number.	Reporting.	Acreage.	Average yield per acre.	Number.	Acreage.	Average yield per acre.		
Corn.....	417	396	2,367	33.8 bushels...	7,237	26,041	23.4 bushels...	7,633	28,411
Cotton.....	30	30	123	765 pounds.....	626	1,560	600 pounds.....	656	1,683
Tobacco.....	27	24	53	884 pounds.....				24	53
Wheat.....	169	157	1,074	15.7 bushels.....	2,161	7,184	11.3 bushels.....	2,318	8,258
Oats.....	62	62	387	16.7 bushels.....	532	2,018	13 bushels.....	594	2,405
Rye.....	70	70	355	15.8 bushels.....	530	1,238	12 bushels.....	600	1,593
Alfalfa.....	50	45	82	2.7 tons.....	29	35	1.5 bushels.....	74	117
Crimson clover.....	16	16	40	$\frac{1}{2}$ ton.....	79	156	$\frac{1}{2}$ ton.....	95	195
Snapling clover.....	52	17	152	$\frac{1}{2}$ ton.....	25	50	do.....	42	202
Red clover.....	14	14	14	do.....	26	22	$\frac{1}{2}$ ton.....	40	36
Mixed grasses.....	40	40	202	1.6 tons.....	128	509	1.2 tons.....	168	711
Cow peas.....	160	150	599	7.7 bushels, or 1.7 tons.	1,337	3,505	6.2 bushels, or 1.1 tons.	1,487	4,104
Soy beans.....	17	17	56	8.5 bushels.....	149	357	7 bushels.....	166	413
Peanuts.....	44	44	261	44.4 bushels.....	515	3,220	29 bushels.....	559	3,481
Potatoes.....	92	90	125	75 bushels.....				90	125
Sweet potatoes.....	19	9	41	117 bushels.....				9	41
Total.....	1,279	1,181	5,931		13,374	45,898		14,555	51,329

The negro farmers of the State are taking increased interest in live stock, especially hogs and poultry. Sixty-three grade breeding dairy animals have been bought through the influence of the county agents; 41 pure-bred hogs have been bought, and 118 additional grade sows have been purchased; 28 new herds have been started; 110 feeding demonstrations with 718 hogs have been conducted, and 51 poultry demonstrations, including 7,402 fowls; 1,202 farmers have been influenced to improve their management of poultry; and 1,249 animals have been treated for various diseases.

The following is a summary of the work with negro boys for the fiscal year 1916-17:

Summary of work with negro boys.

Kind.	Enroll- ment.	Number reporting.	Average yield.
Corn.....	232	201	29 bushels.
Peanut.....	43	41	42 bushels.
Garden.....	17	17	Home use.
Pig.....	4	3	
Tobacco.....	6	6	582 pounds.
Cotton.....	6	6	483 pounds.
Cowpeas.....	13	10	8½ bushels or 1 ton hay.
Potatoes.....	6	4	30 bushels.
Total.....	327	288	

Home-demonstration work.—White: Home-demonstration work was carried on in 41 counties during a large portion of the year, which is an increase of 19 over the previous year. The work was supervised by one State agent, two district agents, and one specialist in home economics. In 15 counties assistant agents were employed for summer work. Girls' canning clubs were organized in 50 counties, with 228 community clubs and a total of 4,326 members, 2,409 reporting. Poultry-club work among the girls was organized in 30 counties, with 1,688 girls, 799 reporting; number of winter gardens, 485; girls making demonstrations in cooking, 763; number of tin cans of vegetables, 166,305; number of glass jars of vegetables, 80,890; number of tin cans of fruits, 7,036; number of caps and aprons made, 1,416; dresses, 101; miscellaneous articles, 617; containers of preserves, 22,660; jam, 7,115; soup mixture, 6,119; pickles, 12,044; cat-sup, 6,698; fruit juice, 1,669; jelly, 16,384.

Among the women the enrollment in clubs was 3,457, the number doing active work, 3,457; home water systems installed, 130; houses screened, 758; containers of fruits and vegetables packed, 1,431,931; pounds of dried fruits and vegetables stored, 128,524; sanitary out-houses built, 38; homemade canners constructed, 3,065; and home-made driers constructed, 388.

Negroes: The canning-club work with negro girls was organized in 49 counties, with a membership of 3,897; winter gardens planted,

639; glass jars of vegetables packed, 28,370; glass jars of fruit, 24,165; caps and aprons made, 4,569; dresses, 866; miscellaneous articles, 2,913; containers of preserves, 5,757; containers of pickles, 20,759; and glasses of jelly, 4,314.

Among the negro women there was a club enrollment of 3,691, 2,831 of whom are doing active work; 2,101 houses were screened; 275,271 containers of fruits and vegetables packed; 126,720 pounds of fruits and vegetables dried and stored; 8,528 gallons of brined vegetables stored; 1,182 sanitary outhouses constructed. The work among the negro girls and women was carried on through 35 county agents under the supervision of one district agent.

The women and girls of the State, including both white and negro, put up during the year under the direction of the home-demonstration agent 2,108,355 containers of fruits and vegetables, valued at \$440,341.60.

Boys' club work.—Boys' club work was provided for in a separate project for the first time this year, and was under the direction of a State agent in club work. The following table gives a summary of club activities:

Summary of boys' club activities.

Kind.	Enrolled.	Reporting.	Kind.	Enrolled.	Reporting.
Corn.....	2,006	369	Peanut.....	104	59
Pig.....	516	167	Cotton.....	34	16
Baby beef.....	42	31	Bean.....	374	101
Poultry.....	422	124	Total.....	3,676	927
Potato.....	178	60			

The total production of corn was 27,727 bushels; pork, 29,502 pounds; beef, 28,550 pounds; poultry, 8,135 pounds; potatoes, 1,331 bushels; peanuts, 2,863 bushels; cotton, 12,380 pounds; peanuts, 29 bushels. The average profit per pig was \$18.48; per calf, \$42.51; per member in potato clubs, \$17.45; per member in peanut clubs, \$80.97; per member in pig clubs, \$36.45; per member in cotton clubs, \$71.57. Special emphasis has been laid upon field selection of seed for all crops, and the use of pure-bred breeding stock in animal work.

Cheese work.—This project is in charge of a full-time specialist. The work is carried on in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture. The purpose is to stimulate the production of cheese in the mountain counties of southwestern Virginia. The work has been gotten well under way this year, there being 11 cheese factories at the end of the calendar year 1917. One of these factories has been run 2 years. The cheese made has been of good quality and has had a ready sale. This industry not only gives a market for the surplus milk produced in a section without a market, but also encourages increased production

of a very valuable food product. The industry has been placed on a firm foundation and the probability is that it will spread through the entire mountain section of the State. The following is a brief summary of the results of the work: Pounds of milk received at cheese factories, 845,343; pounds of cheese produced, 83,894; receipts from cheese sold, \$20,532.29; average cost of making 100 pounds of cheese, \$4.89; average price received per 100 pounds of cheese, \$24.76; average price paid farmers per 100 pounds milk, \$1.89. The average number of pounds of milk required to make one pound of cheese is 10.4.

Animal husbandry.—There are some 31 county and sectional live-stock breeders' associations including dairymen's associations in the State. Six new county breeders' associations have been established during the year.

Through the influence of the specialists and county agents, 300 pure-bred beef bulls were brought into southwestern Virginia during the year. The following is a brief summary of the activities of the specialist who was in charge of this project during the first part of the calendar year, 1917: Number of miles traveled 11,887; visits to county agents, 28; visits to farmers, 54; meetings addressed, 48, with an attendance of 4,445; schools visited, 21; conferences with agents, 95; conferences with business men, 72; conferences with educators, 61; letters written, 570; bulletins and circulars distributed, 675; and breeders' associations organized, 6. The specialist who took charge of the work of this project September 1 attempted to carry on the work that had been begun and at the same time become acquainted with the workers and people of the State. He served as judge at eight county, district, and State fairs. Much of the time of the specialist was devoted to encouraging baby beef club work. He kept in close touch with the breeders' association already in existence and projected another such organization. The work with hogs consisted largely in the work of increased production and the encouragement of the growing of leguminous crops for grazing. Some work was begun looking to the encouragement of the sheep industry. Large areas of the State are particularly adapted to the growing of sheep, and much time and attention will be devoted to this phase of the work by the specialist in the immediate future. The following is a brief summary of the work done by the present leader of this project: Miles traveled, 6,965; meetings addressed, 12, with an attendance of 520; letters written, 109; circular letters sent out, 350; acted as judge at 8 fairs.

Dairying.—This project was undertaken late in the year. The specialist in charge set about to organize cow-testing associations, dairymen's associations, community bull clubs, and the encouragement of silo construction. The high cost of feed and labor makes

the dairy business a hazardous undertaking unless the very best results are obtained in the production of dairy products. Recognizing this fact, the specialist has made every effort possible to have low-producing cows replaced with high producers, and to have the farmers produce as large an amount of feed as possible. The following is a summary of the work of the specialist: Traveled 15,420 miles; visited 23 county agents; visited 242 farmers; addressed 26 meetings, with an attendance of 1,190; attended 9 fairs; prepared exhibits for 2 fairs; organized 2 cow-testing associations and 3 dairymen's associations; erected 1 silo; wrote 246 letters; prepared manuscript for 6 circular letters; mailed out 400 circulars; prepared 10 charts and 70 lantern slides.

Boys' and girls' poultry club work.—This project is carried on in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture. The following is a brief report of the results of the year's work under the leadership of the specialist of this project:

Summary of club work.

	Regular.	Emergency.	Total.
Number of clubs.....	130	.....	130
Number of members.....	1,299	389	1,688
Number of members reporting.....	466	333	799
Eggs set.....	16,211	17,063	33,274
Chicks raised.....	7,837	11,812	19,649
Value of poultry sold.....	\$1,201.91	\$334.66	\$1,536.57
Value of breeding stock sold.....	241.51	.....	241.51
Value of eggs sold.....	515.32	2,919.60	3,434.92
Value of eggs for hatching.....	119.05	.....	119.05
Value of equipment and stock on hand.....	4,227.84	8,497.25	12,725.09
Cost of feed and labor.....	1,232.52	.....	1,232.52
Total profit.....	.....	.....	\$15,438.10
Profit per member reporting.....	.....	.....	19.3
Per cent of members reporting.....	.....	.....	47.31
Number of eggs preserved in water glass, dozen.....	.....	.....	890

Horticulture.—Three specialists were working under this project during the year. There were changes in the personnel, but the number of employees remained the same. The lines of work were demonstrations in pruning, fruit packing, home orchards, home gardens, orchard management, and orchard-survey work. All work was largely conducted through county agents. There were 73 pruning demonstrations conducted, with a total attendance of 1,118; 14 spraying demonstrations, with an attendance of 220; 8 fruit-packing demonstrations, with an attendance of 168; 46 demonstrations in home orchards. Work was started with home-garden demonstration work and carried on on 6 farms during the year. At all demonstrations given and at all meetings of farmers personal instruction was given relating to such points of interest in connection with orchard work as the selection of orchard sites, fertilizer, cultivation, pruning, selection of varieties, spraying, thinning fruit, etc. Much instruction of this character was given through correspondence.

Bulletins on the "Home Garden in Virginia," "Storage of Fruits and Vegetables for Home Consumption," "Saving Garden Seeds," "Hotbeds and Cold Frames," were written and published. An effort was made during the year to procure and combine a complete mailing list of fruit growers of Virginia, with such additional information as the number of acres in each orchard and the different varieties grown.

The most cordial relations obtain with the Virginia State Horticultural Society, and this organization has been of inestimable value in furthering the work of the horticultural specialist.

The following is a summary of the work done by the staff of horticultural specialists: Miles traveled, 48,759; visits with county agents, 227; with farmers, 408; with schools, 31; conferences with business men, 56; educators, 44; newspaper men and others, 24; letters written, 1,906; newspaper articles, 16; circulars, 13; bulletins written, 4; personal advice was given to 656 growers; lectures and addresses, 198, with an attendance of 7,285.

Drainage.—One specialist was employed to carry out the work under this project, which deals with farm-drainage problems. During the year, the specialist traveled 8,635 miles; helped 37 farmers in drainage work; made 10 drainage surveys; 7 drainage maps; visited 9 county agents; worked in 13 counties; was instrumental in having started two tile factories; wrote 360 letters; attended 4 meetings; wrote 2 bulletins; conducted 1 field demonstration; surveyed 625 acres of land; was instrumental in having surveyed by the Washington office 380 acres of land.

Movable schools.—Schools were conducted in horticulture, home economics, and dairying. In horticulture special attention was given to apple and peach packing schools, 12 such schools being held, with an attendance of 365. In the schools for home economics, special attention was given to butter making, fruit and vegetable gardens, food values, sanitation, sewing, and poultry. Twenty-two schools were held, with an attendance of 849. At the State dairymen's association special work was done in judging dairy cows, showing cows that were heavy producers, and discussing herd management and breeding.

WEST VIRGINIA.

Division of Extension. College of Agriculture, West Virginia University,
Morgantown.

C. R. TITLOW, *Director.*

Organization and administration.—The extension division is a regular branch of the college of agriculture on an equal standing with that of the experiment station and of resident agricultural instruction. The director of extension is in charge of all lines of

extension work and is responsible to the dean of the college of agriculture who in turn is responsible to the president of the university.

The organization consists of the director, a man State agent, woman State agent, State agent in charge of boys' clubs, State agent in charge of girls' clubs, two assistant State agents in charge of men's work, an assistant in woman's work, 4 full-time specialists, 5 part-time specialists, 30 regular men county agents, 13 emergency men agents, 26 assistant men agents, 27 district boys' club agents, 12 regular women agents, 10 emergency women agents, and 2 assistant women agents. The emergency and assistant agents mentioned above were employed after the country entered the war. The assistants worked for a nominal salary and expenses. There were no changes in the method of procedure affecting the work. A few changes were made in the personnel of the organization. A poultry-club agent was added during the year and a State agent in charge of home-demonstration work was employed. An assistant in home economics was added also and some changes were made in the specialists, but such changes were made only to combine the work of part-time specialists or to substitute men for those who had resigned. A cheese specialist was added during the year.

The extension work is supported by direct State appropriation, county appropriations, county farm bureaus, and county and district boards of education. There is no formal memorandum of understanding between the extension department and the State department of agriculture, but there is no serious duplication of effort in the activities of the two institutions. A memorandum of understanding exists between the extension division and county and district boards of education. Most cordial relations obtain between the extension division and the other branches of the college of agriculture.

The division is housed in a building leased for that purpose. All necessary furniture, modern equipment for office work, stereoptican slides, charts and maps, canners, cooking utensils, scales, testers, etc., are provided.

The correspondence is handled in a very satisfactory way. All letters of inquiry from the field coming to the college of agriculture are referred to the director's office. Letters are distributed here, each being sent to the person either of the extension staff or of the college of agriculture best qualified to make reply. A record is kept in the director's office of the distribution of the letters. The person replying to the letter sends a carbon of his reply to the director's office where it is filed. No regular library is maintained. Extension employees have access to the university library.

Publications.—Smith-Lever funds are not used in publishing bulletins and circulars. There were issued, however, during the year 67 extension circulars, varying in size from 4 to 32 pages, editions ranging from 1,500 to 30,000 with a total of 288 pages and 356,000 copies. These circulars are arranged in a series running in numerical order and distributed to farmers, farm women, farm boys, farm girls, newspapers, public officials, and college employees. A regular mailing list is maintained. Large additions exceeding the mailing list are distributed by county agents.

Finances.—The following funds were expended for extension work:

United States Department of Agriculture, farmers' co-operative demonstration work.....	\$23, 475. 88
Federal Smith-Lever	32, 131. 50
State Smith-Lever.....	22, 131. 50
United States Department of Agriculture, other bureaus	1, 133. 33
State appropriations	24, 095. 25
County appropriations.....	19, 907. 32
Other sources	10, 355. 25
Total.....	133, 230. 03

Smith-Lever funds were expended on the following projects: Administration, movable schools, boys' clubs, county agents, home demonstration, home economics, horticulture, agronomy, animal husbandry, and dairying. Funds from the United States Department of Agriculture were used in support of the following projects: Dairying, boys' clubs, county agents, and home-demonstration work. The following projects were supported entirely from sources within the State: Agricultural education, correspondence schools, farmers' institutes, and publications.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—In the administration of county-agent work there were employed 1 State agent, 2 assistant State agents, 30 regular county agents, 13 emergency agents, and 26 assistant county agents. Upon the entrance of this country into the war the director of extension anticipated the emergency appropriation by Congress and provided the additional agents to support his campaign, the slogan of which was "West Virginia must feed herself." While the regular demonstration work was not neglected, every possible effort was made to increase production and conservation of food and feed. The organization of farmers into community clubs is one of the outstanding accomplishments of the county agents in West Virginia. The assistance of these clubs at the outbreak of the war made it pos-

sible with a minimum effort on the part of the county agents to reach a maximum number of the farm population. There are 375 rural community clubs, with a total membership of 8,152.

The county agents have made 48,055 visits; traveled 285,598 miles; received 33,368 calls; addressed 5,699 farmers' meetings, with an attendance of 286,481; held 449 field meetings, with an attendance of 7,628; prepared 2,500 articles for publication, distributed 252,649 bulletins and circulars of all kinds; made 943 visits to schools; assisted 448 schools in outlining courses in agriculture; influenced 600 farmers to attend short courses at the agricultural college; visited 8,500 farmers regarding the proper use of fertilizers; influenced 375 communities to buy fertilizers cooperatively, with the result that 10,375 tons were bought at a saving of \$25,937.59; 710 silos were built; influenced the use of 8,506 tons of lime; assisted in organizing 75 farm clubs; erected 206 farm buildings; and furnished 100 plans for buildings.

Crop demonstrations were conducted in corn, oats, wheat, rye, buckwheat, alfalfa, permanent meadows, cover crops, soy beans, cowpeas, white beans, Irish potatoes, and home orchards. There were 290 demonstrators with corn, 220 reporting, total acreage 756, with an average yield of 52 bushels; 12 demonstrators with oats, 9 reporting, total acreage 32, average yield of 38 bushels; 40 demonstrators with wheat, 33 reporting, total acreage of 163, average yield of 20 bushels; 5 demonstrators with rye, 5 reporting, total acreage of 11, average yield of 26 bushels; 2 demonstrators with buckwheat, 2 reporting, total acreage 4, average yield 24 bushels; 106 demonstrators with alfalfa, 87 reporting, acreage 20, average yield $3\frac{1}{4}$ tons; 30 demonstrators with permanent meadows, 21 reporting, acreage 94, average yield, $1\frac{1}{8}$ tons; 300 demonstrators with soy beans, 256 reporting, acreage 626, average yield—seed 9 bushels, hay 2 tons; 15 demonstrators with cowpeas, reporting 15, acreage 39, average yield hay $1\frac{1}{4}$ tons; 50 demonstrators with white beans, 40 reporting, acreage 72, average yield seed 10 bushels; 218 demonstrators with potatoes, 192 reporting, acreage 150, average yield 175 bushels; and 24 demonstrators in home orchards. The number of trees pruned, due to the influence of county agents, was 18,405, and number sprayed, 35,775. County agents assisted in caring for 50 commercial orchards.

Twenty-six feeding demonstrations were carried on with beef cattle, with a total number of 390 animals; 185 pure-bred dairy animals have been brought into the State; 1,294 beef cattle have been brought in through the influence of the agents; 15 beef-breeding herds were started; 30 beef-cattle breeders' clubs were formed with a membership of 330; 374 hog pastures were established; 20 pure-bred sheep were introduced, and 2,685 grade-breeding stock were brought in; 150 flocks of sheep have been started; poultry management has

been improved on 1,986 farms; 3,408 cattle have been treated for blackleg; 1,374 hogs for cholera, and 2,500 sheep for various diseases.

Boys' clubs.—The boys' club work was supervised by a State agent and an assistant in poultry clubs working through the county agents and 27 district club agents. The total number of all agricultural clubs for the year was 5,397, distributed as follows: Corn-club membership, 580; potato-club membership, 1,158; pig-club membership, 906; poultry-club membership, 2,611; miscellaneous-club membership, 142. These were grouped into 350 community clubs. There were 2,073 complete reports made showing 1,725 community-club meetings. The average yield of corn by all club members was 67.7 bushels; the average yield by all potato-club members, 176 bushels; the average weight of brood sows by first-year members, 166 pounds; average size of litter produced by second-year pig-club members, 7; average number of fowls grown by first-year poultry-club members, 20; by second-year members, 100; the total production of corn-club members was 18,094 bushels, of potato-club members, 12,836 bushels; of first-year pig-club members, 58,783 pounds of meat; and of second-year members, 240 pigs; of first-year poultry-club members, 16,904 fowls; second-year club members, 2,388 fowls. The total estimated value of all products, \$82,247; total cost as shown by records, \$20,193.01; net profit, \$62,053.99.

Home economics.—The work in home economics was carried on through a State agent in charge of home economics and an assistant in home economics working through 12 regular county agents, 10 emergency agents, and 2 assistant agents. The women of the State were reached through extension schools, farmers' institutes, farm women's clubs, correspondence courses, and farmers' week. At the extension schools demonstrations and lectures were given relating to canning, household conveniences, and utilization of various food substitutes. Ninety-eight women's clubs were organized, with a membership of over 2,000, who made a study of the various lessons provided by the extension division. Demonstrations and lectures were given club members at their regular meetings. Through the community clubs canning kitchens were established in a number of counties, at which large quantities of vegetables and fruits were conserved under the leadership of county agents and others specially trained to lead in the work. During farmers' week at the university, delegates from nearly every club in the State were in attendance and reported upon the work being done by their clubs. They were instructed through demonstrations in the serving of seasonable dishes at low cost, in the utilization of war breads, and other important substitutes. The total number of containers of fruits and vegetables put up by the women of the State was 3,062,110; total number of pounds of dried fruit and vegetables stored, 95,170.

Among the negro women and girls, clubs were organized in the four counties in which the negro population is found to any extent. Demonstrations were given in canning and drying; negroes were encouraged to grow gardens for home consumption; in some instances negro teachers assisted in this work, especially in connection with the negro girls' clubs. Incomplete reports from the workers in this work show the canning, brining, and storing of the following: 2,324 quarts of vegetables, 9,178 pounds of cabbage, 626 bushels of potatoes, and 225 bushels of turnips and onions.

Girls' club work.—This work was carried on by one State club agent working through 12 regular agents, 10 emergency agents, and 2 assistants. Girls have been organized in 20 counties. There were 109 community clubs, with 834 regular members and 500 associate members; 511 club meetings were held and 16 canning schools.

The following is a summary of the work of the canning-club members: 53,599 cans of fruit, vegetables, and preserves, valued at \$9,947.63, were put up. There was an average income of \$28.83 for each girl. Twelve girls were enrolled in butter-club work, 10 reporting; 29 cows were managed by these girls for three months, producing in that time 1,813 pounds of butter, valued at \$710.60.

Horticulture.—During the year one man gave his entire time to this project. Other members of the experiment station and college staffs did extension work where the demands were sufficiently great to make it necessary for them to assist. The main object of this work was to give instruction and aid to farmers through county agents. Much attention was given to training county agents, especially those not particularly strong along horticultural lines. Forty-four orchard demonstrations located in 20 counties received supervision and assistance from the specialist in horticulture and those assisting him. These demonstrations are largely with home orchards. Dusting demonstrations were carried on with large commercial orchards in the eastern part of the State, and through extension schools, farmers' institutes, and correspondence courses, a large number of farmers were reached with instructions relating to fruit growing.

The following is a summary of the work of the specialist and those assisting him: Farmers' institutes attended, 28; extension schools, 12; pruning, spraying, and packing demonstrations, 86; visits to farms, 479; special meetings and fairs, 35; number of people addressed at meetings, 14,084; miles traveled, 23,396; garden demonstrations, 10; inquiries answered, 1,200; and publications written, 7.

Animal husbandry.—One specialist gave full time to this work. He was assisted by several members of the experiment station and college staff. The work consisted largely of encouraging better breeding, feeding, and management of beef cattle, sheep, hogs, and horses;

construction of silos; building and remodeling of barns; judging at county fairs, club exhibits and related lines of work. The various agencies through which these lines of work were carried to the farmers of the State are extension schools, farmers' institutes, live-stock judging demonstrations, live-stock associations, and personal correspondence. Twenty-four feeding demonstrations were carried on in 11 counties; 1,294 farmers pledged themselves to use only registered sires; 9,749 cows were bred to pure-bred sires; 38 barns were built; 575 silos were constructed; and 3,359 cattle were vaccinated for blackleg.

Agronomy.—During the past year a specialist in soils and crops carried on extension activities as follows: Publications were written on "Buying and Using Fertilizer," "Farm Manure, Field Beans as a Valuable Food Crop," "Some Things the Experiment Stations Have Found Out About Corn," and "Nitrogen Fixation and Legumes"; 1,300 bottles of soy bean inoculation culture were made and distributed; 2 correspondence courses were conducted; assistance was rendered 160 farmers' institutes and 24 extension schools; and 453 letters were written.

Extension schools.—The attendance and interest shown at these schools was very gratifying. The kind of work given is improving each year. The lectures are taking the direction more nearly of demonstrations. These schools were held in connection with the farmers' clubs of the county. Twenty-four such schools were conducted during the year for a period ranging from three to five days. There was a total attendance of 1,857. Farmers' week at the university has continued to make rapid development. The total attendance in 1917 was 914, and practically every county in the State was represented. County farm bureaus, community clubs, and farm women's clubs sent delegates, and the counties sent to the prize winners course the boys and girls who had made the highest records in club work in their counties.

OTHER PROJECTS.

Agricultural education.—This work was in charge of a part-time specialist and was along two main lines—namely, correspondence with rural-school teachers, and lectures and conferences of teachers at meetings and institutes. Four circular letters on "How to Teach Definite Phases of Public School Agriculture" were prepared. These were sent out to more than 2,500 teachers. Two correspondence courses of 20 lessons each were written for teachers of nature study and elementary agriculture. Seventy teachers were enrolled in these courses. Addresses were made at 12 teachers' institutes and conferences were held with teachers in 6 counties.

Dairying.—This project is in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture, and is under the leadership of a full-time specialist. Work was carried on along these lines: Encouraging better breeding, feeding, and management; building silos; forming cow-testing associations; keeping of herd records; organizing dairy associations and cooperating with them; dairy work with boys and girls; and encouraging the establishing of cheese factories in mountain sections. This work has been carried on through extension schools, farmers' institutes, visits to farmers, and in cooperation with county agents. The specialist has traveled 12,736 miles, delivered 78 lectures to 2,803 people, and wrote 1,108 letters. In addition the specialist attended 10 extension schools and delivered 44 lectures to 1,377 people. As a result of this specialist's work in connection with the manufacture of cheese it has become necessary to employ a cheese specialist.

Farmers' institutes.—Farmers' institutes are receiving stronger support from year to year because the work given is intended to fit in with the needs of the community. They are no longer meetings where general subjects are discussed, but are definite and systematic parts of the program of the community's plan of work. The type of instruction given in the beginning of these institutes was quite elementary, but as the years go by the demand calls for more advanced instruction.

The following is a summary of institute work for the fiscal year 1916-17: Number of two-day institutes, 95; number of one-day institutes, 49; total attendance, 49,250; average attendance for each session of institutes, 84.

Correspondence courses and reading circles.—Fourteen correspondence courses were offered, the lessons were prepared, and the manuscripts graded by the regular teachers of the college of agriculture; and 144 persons received instruction in these various courses. There were 20 lessons in agriculture for teachers; 20 in nature study; 10 in farm crops; 20 in soil fertility; 10 on beef cattle; 10 on sheep; 10 on hogs; 10 on farm dairying; 20 on elementary farm management; 20 on commercial orcharding; 10 on small fruits; 20 on vegetable gardens; and 20 on farm fertilizer. Seventy-four communities undertook the reading-circle work or a systematic study of various agricultural subjects at their club meetings. In order to assist these clubs in their studies, the extension division prepared outlines on several subjects and furnished them free to the members of the clubs desiring them. During the past year outlines of the following subjects have been furnished: Six lessons on soil fertility; 8 lessons on animal husbandry; 8 lessons on farm crops; 11 lessons on horticulture; and 6 lessons on farm management.

EXTENSION WORK IN THE NORTH AND WEST.

INTRODUCTION.

The outstanding feature of the extension work of the Northern and Western States during the year was the promptness and efficiency with which it responded to the appeal of the President for greater food production. It was at once evident that the agricultural extension system, supported by the cooperation of Federal, State, and county funds, was the logical organization for furnishing the necessary leadership in the campaign for greater food production. In a majority of the States the State council of defense or committee of public safety created a committee on food production and conservation which relied upon the cooperative Federal, State, and county extension forces for the execution of its program.

As most of the agricultural counties in the North and West were without agricultural agents, in many of the States the extension divisions assigned not only their own staff but instructors in the agricultural colleges to counties or districts, so that every section of the State had a local extension representative. In several States the State defense councils, or similar State war agencies, financed the salaries of agricultural agents for counties not already provided with them until the passage by Congress of the emergency "act for the stimulation of agriculture and facilitating the distribution of products."

Through this State-wide organization several States made surveys or censuses of the crop yields and planting planned, and supplies and needs of seed, live stock, and labor. These surveys indicated the immediate needs and furnished a basis for practical programs of work to meet the local situations. State-wide campaigns were very generally conducted for increased crop and live-stock production and for food conservation, and thousands of farm laborers were placed through the county offices.

ORGANIZATION AND ADMINISTRATION.

The organization of the extension work in the Northern and Western States and its relation to this department was practically the same as during the preceding year. Only one State changed its extension director, the Utah director resigning to become president

of the State agricultural college. At the end of the year numerous changes occurred in the personnel of the extension staffs, owing to the rapid enlargement of the work and to enlistments in war activities.

The most notable progress was an increase of about 25 per cent in the number of county agents and better organization of the county work. This increase in the number of agents necessitated a larger supervisory force, and many assistant State leaders of county agents were appointed, each usually supervising the work in a certain district or group of counties.

The farm-bureau association is now becoming generally recognized as necessary for the most efficient extension work. The farm bureaus are assuming more responsibility for the development of a local program of work to be recommended to the county agent and the extension division of the agricultural college, and are developing an increasing amount of local leadership for the projects undertaken.

Several States for the first time created separate departments of home-demonstration work and of boys' and girls' club work, as both of these phases of extension are receiving increased recognition. In many cases the State legislation permitting the county to appropriate money for the support of agricultural extension work limits the use of these funds to the salary and expenses of the county agents. There is need of amending these acts so that home-demonstration agents, boys' and girls' club leaders, and other specialists may be employed where the county desires.

The increase in the number of county agents necessitated also a larger amount of assistance for them from subject-matter specialists. This resulted in the employment of more extension specialists and also in the specialists doing most of their work through the county agents.

With the development of extension work, more attention was given to plans of organization and methods of extension teaching. Regular conferences of all members of the State staff, held monthly or semi-monthly, and semiannual or quarterly conferences of county and State workers, are coming to be appreciated as necessary to secure vision, teamwork, and efficiency.

In general, both the extension divisions of the agricultural colleges and the county farm bureaus are coming to have more the function of "service bureaus" than of "extension" agencies in the older and original sense of the latter term—i. e., as a means of securing the general use of the results of agricultural research. The relationship between all parties concerned in this system is developing into one which, on the one hand, recognizes the strength and vitality of decentralized democratic control of program and policies, which are executed with the assistance of technically trained paid leaders. On

the other hand, the fact that these local workers are partly supported by State and Federal funds gives them the benefit of supervision by the State and Federal extension offices, which are able to offer suggestions based upon accepted scientific research and the varied experience of all sections and which can command the services of the best agricultural scientists in meeting special local problems. A mechanism is gradually being evolved for bringing the method of science into the service of democracy for the progress of agriculture.

FINANCES.

In the 33 Northern and Western States \$3,419,436.91 was used for extension work during the fiscal year ended June 30, 1917. This was provided from the following sources: Federal Smith-Lever, \$924,886.31; State Smith-Lever, \$594,886.31; United States Department of Agriculture, \$438,906.93 (States Relations Service, \$369,401.14; other bureaus and offices, \$69,505.79); State appropriations, \$517,477.27; college appropriations, \$181,999.06; county appropriations, \$601,581.57; other sources within the States, \$159,699.46. (A detailed statement by States is shown in the table on pp. 399, 400.)

Smith-Lever funds were spent as follows: County agents, \$587,463.30; administration, \$196,541; printing and distribution of publications, \$38,453.93; home economics, \$162,726.19; boys' and girls' clubs, \$97,819.48; extension schools, \$65,886.96; farm management, \$45,610.75; animal husbandry, \$42,105.27; poultry, \$25,820.55; dairying, \$48,509.16; animal diseases, \$13,868.68; agronomy, \$56,166.49; horticulture, \$40,103.10; botany and plant pathology, \$12,268.15; entomology, apiculture, and ornithology, \$13,639.15; forestry, \$7,762.90; agricultural engineering, \$22,638.94; rural organization, \$6,971.61; marketing, \$2,883.80; exhibits and fairs, \$3,197.40; and miscellaneous specialists, \$29,335.79. The total funds from all sources expended by the 33 States for major projects are as follows: County agents, \$1,614,541.19; administration, \$343,060.16; home economics, \$197,984.61; boys' and girls' clubs, \$235,051.23; extension schools, \$134,231.58; farm management, \$97,882.80; animal husbandry, \$67,833.24; dairying, \$123,480.50; agronomy, \$70,741.11; horticulture, \$58,660.04; farmers' institutes, \$89,500.40; publications, \$85,888.01; miscellaneous agricultural specialists, \$37,719.66; poultry, \$35,311.44; agricultural engineering, \$36,430.16; and marketing, \$17,615.07.

Approximately 63.8 per cent of the total funds was used for salaries of extension workers, 19.6 per cent was used for travel expenses, and only 16.6 per cent for equipment, supplies, labor, publications, and all other expenses.

PUBLICATIONS.

Extension publications to the number of 407, aggregating 3,996 pages, were issued in the 33 Northern and Western States during the past fiscal year, a decrease of 151 publications and 2,587 pages from the previous year. Many of the publications were issued to meet special needs arising from the campaigns for food production and conservation demanded by war conditions. There has been a notable development of the publication commonly known as the "Farm Bureau News," which is published by the county farm bureaus and sent to all its members. In several States the State extension division also issues a similar monthly, covering the extension work of the whole State, and sends it to all extension workers and farm-bureau officials.

COUNTY-AGENT WORK.

Organization and administration.—The number of county agents in the Northern and Western States increased from 419 on June 30, 1916, to 542 on June 30, 1917, and the number of county-agent leaders and assistant county-agent leaders was increased by 19.

The growth of the farm-bureau movement during the year was satisfactory. Most of the States adopted it in principle, and the farm bureaus uniformly have increased their membership, the total membership being 161,391. The organization of farm bureaus is now quite generally recognized as a necessary prerequisite to the installation of a county agent. In a few middle western and far western States the farm-bureau work is in need of further organization. The county agents during the year gave more attention to the development of projects and to enlisting the counsel and cooperation of farm-bureau committees, both in explaining and in executing the work. More responsibility was placed on the farm bureau in the local development of a program of work to be recommended by the county agent to the extension division at the agricultural college. The county agent's position has assumed more the character of a county or deputy director of extension and less that of a promiscuous farm adviser. Many of the farm bureaus have established a news service through the medium of a regular paper published monthly by the farm bureau. The county agent contributes freely to this paper, explaining the extension projects under way and giving results of the demonstration work. The publication is confined to the activities of the farm bureau, and is purely local in tone and character, and does not attempt to enter the field of the local or farm press. Usually it is sent to all members of the farm bureau and sometimes to all farmers in the county. In some cases these papers have been

admitted to the mails as second-class matter and a regular subscription price charged.

Results.—The following summarizes some of the more important lines of work carried on during the year: The totals given are for the calendar year 1917. Sixty-three thousand eight hundred and thirteen farmers were assisted in selecting seed corn; 1,263,237 acres were planted with fall-selected seed corn; 36,538 farmers were assisted in selecting seed corn for germination, from which were planted 946,563 acres with tested seed; 56,599 farmers treated their seed oats for smut, seeding 1,162,194 acres; and 23,306 farmers treated their seed potatoes for disease. Help was rendered in connection with the growing of hay on 4,245 farms, alfalfa on 8,290 farms, sweet clover on 2,051 farms, soy beans on 6,541 farms, cowpeas on 936 farms, barley on 2,209 farms, rye on 4,834 farms, and 8,954 orchards were cared for following the agent's suggestion. In livestock work 190 registered stallions were secured, 3,285 registered bulls were secured, 4,836 registered cows, 1,469 registered rams, and 2,974 registered boars. Three thousand three hundred and seventy registered sires were transferred from one community to another; 182 cow-testing associations were organized, with 127,835 cows under test in these and other organizations previously organized by the agents; 8,724 cows were discarded as a result of tests during the year; 10,986 farmers adopted balanced rations figured by the agents; 160 breeding associations were organized, with a total membership of 4,115; 36,392 animals were tested for tuberculosis, 197,508 animals treated for blackleg, and 204,545 hogs vaccinated for hog cholera by veterinarians or farmers on the advice of the agent. Four thousand nine hundred and eighty-two crop-rotation systems were planned; 1,188 drainage systems developed, involving an area of 374,916 acres; 17,333 farmers were assisted in securing commercial fertilizer or in using it following the agent's suggestion. Soil was tested for acidity on 11,163 farms. Three thousand and forty-nine farm-analysis records were taken by county agents, and on 3,167 farms the farm-management system was modified in some way as a result of farm analysis; 12,841 farmers were induced to keep farm records, either partial or complete; 289 farmers' exchanges were organized and a business amounting to \$4,449,467 was transacted through the exchanges organized in the past year or in previous years by agents; 348 other purchasing and marketing associations were organized by the county agents, which, together with such associations organized in previous years, did a total business of \$14,934,316, effecting an approximate saving to the farmers of \$1,419,937. In carrying forward the work the agents visited 157,683 farmers, making a total of 287,323 visits, while 468,514 farmers called on the agents at their headquarters, asking advice in regard to some farm operation; 55,432 meetings were held

under the auspices of the county agent, which were attended by 3,059,387 farmers; 3,973 boys' and girls' clubs were organized, involving a membership of 90,432. The county agents sent out 747,916 letters to farmers other than circular letters; held 3,505 extension schools, to which they devoted a total of 4,985 days. There were enrolled 321,276 farmers at these schools. Specialists from the agricultural college participated in meetings or demonstrations in 14,545 cases and contributed greatly to the value of the work.

War activities.—The declaration of war brought new duties to the county agents. Crop and labor surveys were made in several States; available seed stocks were located and distributed; tractor power was made available; credit facilities were established and provision made for meeting an acute labor situation; increased crop-production campaigns were inaugurated, with special reference to spring wheat, corn, oats, barley, buckwheat, potatoes, and sugar beets. Increased live-stock production was stimulated, particularly with hogs, sheep, and poultry. Food-production campaigns were planned; home gardening and the canning and drying of fruits and vegetables were given special emphasis. The county agents took part in the local war-work activities, such as the Red Cross, Liberty Loan, and other campaigns, and gave assistance to the War Department in the purchase of horses for the Army; helped organize farm-loan associations, distributed circulars, posters, etc.; gave information and collected data for various departments of the State and Federal Governments. They held meetings and made addresses acquainting the farmers and people generally with the issues of the war. This brought to the county agents many new duties and new responsibilities, and they were courageously and effectively met.

In the special war activities of the agents 66,036 laborers were supplied to the farmers through the agent or farm bureau, while 3,604 women were secured for household help. Fourteen thousand seven hundred and sixty-nine additional cows were bred as the result of special campaigns; 8,795 horses were furnished for the Army, while the number of live stock on farms was increased as the result of special activities, as follows: Horses, 986; cattle, 43,405; hogs, 130,125; sheep, 148,211; poultry, 327,095; 10,499 calves were saved from slaughter. Farmers were assisted in securing 756 tractors, 603 tractors were rented or loaned to farmers, and 2,011 farmers were assisted in securing sprayers. One hundred and seventy-one public markets were established, at which were sold \$2,695,406 worth of farm products; 8,741 farmers were assisted in securing farm credit for the purchase of seed or fertilizers, and assistance was rendered in the organization of 624 farm-loan associations. Forty-six thousand three hundred and ninety-one sows were bred as the result of special campaigns.

In the table below are given the results of the special war emergency crop-production campaigns conducted by the counties having agents at the outbreak of the war:

Crop-production campaigns.

Crop.	Estimated increased yield, all campaigns.	Farmers assisted in securing seed.	Seed secured for farmers.
	<i>Bushels.</i>		<i>Bushels.</i>
Spring wheat.....	3,796,532	7,298	249,483
Oats.....	3,831,510	6,599	243,233
Corn.....	7,774,124	19,128	110,111
Buckwheat.....	630,135	13,883	55,902
Spring barley.....	1,445,293	2,488	49,263
Potatoes.....	13,648,282	40,759	441,886
Beans.....	1,029,780	13,286	51,566
Winter wheat.....		12,363	555,429
Rye.....		5,889	131,417
Winter barley.....		216	8,499
Other crops.....	612,109	10,198	49,201
Total.....	32,767,756	132,107	1,946,020

In the fall of 1917 the agents assisted in securing 669,477 bushels of seed corn. They also did valuable work in connection with the food conservation campaigns. One hundred and sixty thousand one hundred and sixty-three persons were assisted in home gardening work; 82,434 people were given information in regard to the storing of fruits and vegetables; 4,684,423 quarts of fruits and vegetables were canned by adults as a result of the canning demonstrations conducted by the agents. This does not include work done with boys' and girls' clubs. Seven thousand six hundred and thirty-one demonstrations were held for women, and 467,394 pounds of fruits and vegetables were dried as a result of special drying campaigns. A total of 34,613 demonstrations were conducted either to show methods or results, involving 2,084,589 acres of crops and 149,820 of live stock.

HOME ECONOMICS.

Rural work.—Home-economics extension work in the 33 Northern and Western States made rapid progress during the year. On July 1, 1916, 12 county home-demonstration agents were employed in 12 States; on June 30, 1917, 17 county home-demonstration agents. There were also 97 home economics extension specialists employed cooperatively by the States and the United States Department of Agriculture.

When the United States entered the war and it became recognized that the food problem was likely to become acute the housewives of the country were called upon to assume large responsibility in making rapid readjustments of the food habits of American homes. This

was deemed necessary for two reasons: First, to release portable food for our allies overseas; and, second, to make the rapidly shrinking value of a dollar still serve its purpose in providing nourishing food for the families at home.

Immediately on the passage of the food production bill an effort was begun to complete the overhead organization of home-demonstration work in all the States of the North and West so that women might be trained for the selection, preparation, and conservation of food as war-emergency work in both rural and urban communities. Home-demonstration agents were established in every State as rapidly as the people of the communities could be prepared to receive the work and women with suitable personality and training could be secured to carry it forward. By January 1, 1918, there was a total force of 404 women paid from these funds engaged in home-demonstration work in the 33 Northern and Western States, besides the scientific staff in Washington and the necessary clerical force. The field workers were divided as follows: 35 State leaders, 30 assistant State leaders, 282 county home-demonstration agents, and 57 urban home-demonstration agents. One hundred and thirty of the agents covered more than one county.

The work of both rural and urban home-demonstration agents has been carried on with special emphasis on food conservation and preservation along lines of canning, drying, salting, and storing. Stress has been placed also upon the use of perishable and locally produced foods to lessen the demands upon transportation facilities. Demonstrations have been given on the conservation of wheat by mixing corn, barley, and potatoes with flour in bread making. Excessive use of meat and sugar have been discouraged and the use of recommended war substitutes was taught. The greater use of milk was encouraged. These changes were urged both as a war-emergency measure and because of the individual benefit in economy and health.

The work has been carried on in close cooperation with other Federal, State, and local agencies carrying on war work along food-conservation lines. These cooperating workers include home-economics directors of the Food Administration, State chairmen of the Women's Committees of the Council of National Defense, and the Civilian Relief of the Red Cross. Assistance was extended to the National Women's Liberty Loan Committee in carrying into the homes of the country literature and subscription blanks for subscriptions for Liberty bonds.

Because of the presence of the home-demonstration agent within the county and the necessity for organized support for her work, the farm bureau has been expanded to include home-demonstration work as a regular feature.

Some specific cases of war conditions have been met with gratifying results and may be indicated as follows:

1. Food shortage was met by preservation of perishables and conservation of specific foods with the following specific results: In one county 200 local leaders gave 500 demonstrations; as a result 579,912 quarts were canned. Another county canned 480,000 quarts valued at \$192,000. In one State 66,972 quarts of fruits and vegetables were canned, 25,719 glasses of jelly were made, 3,083 pounds dried products were produced; estimated value, \$25,343. In one State a home-demonstration agent supervised the collection of 4 tons of fruit which was sent to the southern part of the county to relieve the fruit shortage which existed because of a drought.

2. High prices were met by demonstrations showing the use of cheaper substitutes, by encouraging direct marketing, and by studies of food values. Home-demonstration agents have promoted plans for direct marketing of farm produce by assisting to organize egg circles, by arranging parcels-post connections between producer and consumer, and by furnishing information regarding curb markets. Systematic educational work has been done through study clubs and the training of leaders.

3. Labor shortage of farm, home, and industries was met by instruction in household management and the introduction of labor-saving devices in the home. In one county 150 fireless cookers were made under the direction of a home-demonstration agent.

4. War problems of the home which emphasized the lack of adequate instruction for women in home economics were met by instruction through demonstrations on the subjects of health, food, fuel, clothing, and shelter. Home-demonstration agents promoted campaigns for school lunches, better babies, home nursing, and the increased use of milk.

5. The need for relieving transportation facilities for war service was met by encouraging the use of locally produced foods and teaching their uses. Local cereals were substituted for wheat, as, for instance, emmer in Colorado and milo maize in New Mexico and Arizona.

6. The need for home production to increase the food supply was met by stimulating home gardening and other industries of the home. Many homes have become almost self-supporting units.

7. The home problems of foreigners in America were met by home-demonstration agents training foreign women to carry the Government's message to their people. Special schools, special committee work, and specially prepared literature were utilized in this work.

Twelve articles upon the organization, methods, and subject matter of home-demonstration work were prepared and circulated among

the county home-demonstration agents and home-economics extension workers.

Urban work.—Due to the fact that the legislation authorizing home-demonstration work in cities was not passed until August, 1917, some months after the United States entered the war, and to the fact that city women are experienced in methods of promoting enterprises through organized effort, movements for food production and conservation were well under way before the appointment of home-demonstration agents in the cities took place. The appointment of urban agents therefore met with immediate appreciation and cooperation from city women, who eagerly welcomed the help of a paid, trained home-economics worker who could devote full time to home-demonstration work. (Up to Dec. 1, 1917, urban agents were appointed in 74 cities of the 33 Northern and Western States and in the District of Columbia, with additional plans under way and appointments pending for the work in other cities and States.)

City women showed genuine appreciation of this scheme for assistance of city housewives, where there is more housekeeping to the square mile than in rural districts, and where frequently the problem of providing food for the family is much more difficult than in the country.

A city organization was developed through which to reach as many housekeepers as possible. This included an executive committee and an advisory council, with community committees for furthering the work in the various districts into which the cities had been divided. In many cities schools were used as community centers for the districts. Cooperative relationships were established with organizations within the city, including the city government, schools, churches, women's clubs, the press, chambers of commerce, social-service agencies, and the local representatives of the farm bureau, the Council of National Defense, the Food Administration, and the Red Cross.

In cities where a strong local committee for food conservation was already organized before the assignment of urban home-demonstration agents, the home-demonstration work was affiliated with such committees rather than a duplicate organization being created for the same general cause. Such affiliation, however, did not prevent cooperation with other agencies in the city.

The importance of the urban home-demonstration agents in solving the food problems of the war can scarcely be overrated, for they have furnished expert information to city housekeepers for their crusade in food conservation, which is a concentrated problem in cities as the great centers of food consumption. Large-scale results in the increased use of locally produced foods, in the preservation of perishables, and in the introduction of substitutes for foods needed overseas were secured, because the urban agents found it possible to

promote community-wide efforts through prompt cooperation from the multitude of organizations and agencies to be found in any city.

Work in the District of Columbia.—Urban home-demonstration work was started in the District of Columbia soon after Federal funds became available, under the joint supervision of the Office of Extension Work South and the Office of Extension Work North and West. The first work in food conservation was started with the cooperation of the local branch of the National Council of Defense and the agricultural agent of the District. This included efforts to mobilize women trained in home economics for volunteer service, demonstrations in the preservation of foods by canning, drying, and salting, and in the war cookery of foods not needed for shipment overseas. Talks, conferences, and demonstrations were given in various community centers. A Girl Scout home-demonstration troop was trained to aid at public demonstrations and in home canning. Before a more complete organization of the work in the District had been perfected the city leader was called to Red Cross service in France, and had not yet been replaced at the close of the year. The demand for demonstrations, information, and guidance in food conservation by groups of city women was so great that two assistant urban agents for the District were fully engaged in meeting that demand.

BOYS' AND GIRLS' CLUB WORK.

Organization and administration.—Each of the 33 Northern and Western States cooperated in conducting boys' and girls' extension work during the season of 1917, the work in 28 States being carried on with both regular and emergency funds and that in the other 5 States with Smith-Lever and emergency funds only. Thirty-two State leaders, 158 assistant State leaders and district leaders, and 98 county leaders devoted their entire time to the work. There were also 11,325 volunteer leaders in charge of local clubs who were either paid from local funds or worked without pay.

The club activities were conducted through the farm-bureau organizations as far as possible. The cooperation of granges, schools, business organizations, fairs, associations, etc., was also secured. These gave additional impetus to the work through finances and encouragement as well as by providing for local leadership. Permanent organization and leadership were the aim, with a county club leader in charge of all of the junior work of the farm bureau. This county leader gives his entire time to the organization, supervision, follow-up, and closing of the club activities in the various projects. These county club leaders articulated with the district, assistant State and State leaders in the department's plan of food production and conservation, and the improvement of agriculture and home life.

War program.—As a distinct contribution to the war program the boys' and girls' clubs followed out the requests of the Department of Agriculture by contributing directly to the meat supply through pork, baby-beef, poultry, and rabbit raising, also by sheep and wool production; by assisting in the sugar-saving campaign, by growing sugar beets and manufacturing sugar-beet sirup in the homes; by using substitutes for wheat; by war cookery; by adding to the fat supply by increasing pork production through pig clubs; by increasing the food production through corn, garden, potato, and tomato clubs; and by aiding the conservation program through canning, drying, and food preservation.

Demonstrations.—Club members and often their families received demonstrations from county, State, and national leaders in food conservation and production, and in turn at the close of the season during achievement day programs and club meetings, or at the fairs and festivals returned to the community the results of the year's experience in improved practices in agriculture and home economics. Thus each community in which a club has been well organized received the benefit of the demonstration work through the boys and girls. The demonstration idea was one of the greatest factors in vitalizing the war-time program. The national club members' pledge taken by all members at their regular meeting was, "I pledge my head, my heart, my hands, and my health through food production and food conservation to help win the world war and world peace." It represents a worthy war-time aim.

Results and achievements.—From the reports received from the leaders in charge the total value of the products as produced by the club members was \$3,681,329.49. The total cost of supervision and overhead expenses, Federal, State, and local, was \$329,935.29. The average annual cost of supervision per club member completing all the requirements was \$2.03, and per club member enrolled \$1.74. The average value of products reported per club member was \$21.89. This represents only the results in the productive club enterprises that can be measured in dollars and cents. There were also many other nonprofit clubs, including cow-testing, dairy record, butter making, flower, made-over garments, and home beautification. In addition to the regular club work a war-time significance was lent to the clubs through demonstration and community cooperation with a view to increasing the food supply of meats, fats, sugars, and wool; conserving food by canning, drying, and sugar saving; and demonstrating how to save wheat and make over garments. The club members also rendered much assistance in Red Cross work. During the year, 1,863,087 pieces of literature were distributed by the Department of Agriculture and 1,883,098 by the States.

Summary of results of boys' and girls' club work.

Projects.	Number of members making complete report.	What they produced.
Corn clubs.....	7,249	456,873.47 bushels.
Potato clubs.....	8,999	325,786 bushels.
Bean clubs.....	321	126,460 pounds.
Grain-sorghum clubs.....	233	203,383 pounds.
Garden clubs.....	80,512	\$999,967.68 worth of fresh vegetables.
Canning clubs.....	25,641	1,578,510.5 quarts fruits, vegetables, meats and soups, and 217,160 jars of jelly.
Sugar-beet clubs.....	4,916	28,864 tons.
Poultry clubs.....	4,376	106,358 chickens and 33,370 dozen eggs.
Pig clubs.....	7,382	10,583 animals (1,797,196 pounds).
Baby-beef clubs.....	486	415 baby beefs.
Sheep clubs.....	63	178 lambs.
Calf clubs.....	487	599 calves produced.
Bread clubs.....	5,242	316,698 loaves of bread.
Garment-making clubs.....	13,165	92,189 garments.
Cooking and home economies clubs.....	1,244	\$5,753.10 worth products saved.
Home-handicraft clubs.....	307	1,288 pieces.

All-star club work.—Special effort is made to get the boys and girls to achieve high standards in food-production and food-conservation work through contests and the awarding of medals, prizes, etc. When a club member makes the best record in his State for any year in any given project he is declared a State champion and becomes a member of the national all-star club. The cooperative extension leaders endeavor to keep in touch with these members from year to year with a view to making them community leaders, so they will be a definite influence for the improvement of agriculture in their home communities. There are now several hundred of these members who are being followed up from year to year or until they reach manhood or womanhood, when they are encouraged to go into the farm-bureau activities.

Outlook.—Since the value of trained leadership, a permanent organization, and a practical program of work have been definitely recognized by the public, both rural and urban, as well as by the extension directors and leaders interested in the work, the future promises great achievement for the boys' and girls' club work and a more permanent place in the county farm bureau and its extension work with the entire family. The definite contribution made by the boys and girls through this extension work since the war began has shown the increasing need for them in the work of food production and conservation.

The work of the year may be summarized as follows:

1. The change from a temporary organization and part-time leadership to a permanent organization and full-time leaders as a regular part of the farm-bureau program of work will serve to give stability and permanency to the work.

2. The boys' and girls' extension work is helping in a very effectual way to develop the best there is in a community, as well as to carry

the best information from the department, colleges, and experiment stations to the rural people, and through this information the work is improving the practices of the farm and of the home.

3. This type of extension is serving to unite rural and city people by giving equal opportunity to the boys and girls to become acquainted with America's greatest industry and mode of living.

4. The work is showing that boys and girls can do manly and womanly jobs in food production and food conservation in the spirit of the game through contests and achievement programs.

5. The boys' and girls' extension work offers an opportunity for the department and the colleges of agriculture to teach the common, fundamental practices of agriculture and home making to each generation of children, as well as to improve the practices of the old and young.

6. The future is assured through this work of having a larger number of adults who have been trained through club work in the fundamental needs of team work, cooperation, and the principles involved in community building and national unity.

FARM-MANAGEMENT DEMONSTRATIONS.

Farm-management demonstration work proved its value in extension work more than ever during the past year. The demand for the economic viewpoint in agricultural extension work has been increasingly great. Especially has this been so under the abnormal war conditions. Farmers have needed a guide to help them in planning farm operations. To this end many extension specialists have cooperated with farm-management demonstrators to give farmers the information which they desire about their business.

Studying farming from an economic standpoint places the farm business on a sounder foundation. Farmers have demanded help in keeping simple farm accounts and in many cases have requested work on cost of producing farm products. The demands have been so great that much of the work was conducted with groups of interested farmers rather than with individuals. The work was conducted by county agents and other local leaders with the aid of the demonstrator when so requested. One additional State started the work, making a total of 27 States which cooperate with the United States Department of Agriculture in farm-management demonstrations. This cooperation involved the joint employment of 24 men in 18 of these States. The work was introduced in 138 more counties, bringing the total number of counties with supervised farm-management demonstrators up to 342.

The following statements outline briefly the object of the work as conducted in the majority of the States at the present time:

(1) To demonstrate to farmers in connection with their own farms a practical method of recording, summarizing, and analyzing the farm business in order to decide upon modifications which promise to increase the effectiveness of their work.

(2) To demonstrate to farmers the importance of an efficient organization and administration of the farm business and the relation thereto of certain suitable factors.

(3) To increase the effectiveness of county-agent work by establishing the economic viewpoint.

The table following shows the number of county agents and farmers cooperating in farm-management demonstration work for the past three years. It indicates very plainly the progress made, and also points out the field for future development.

Much of the work in the past has consisted of teaching local leaders. Future expansion lies along two lines—that of training more local leaders and that of extending the work to more farmers.

County agents reporting farm-management demonstration work and farmers assisted by them to start farm accounts.

State.	1915		1916		1917	
	County agents.	Farmers starting accounts.	County agents.	Farmers starting accounts.	County agents.	Farmers starting accounts.
Arizona.....			2	59	4	69
California.....	6	81	4	81	10	1,643
Colorado.....	7	169	6	99	11	185
Connecticut.....	5	81	6	150	5	144
Delaware.....	2	1503	2	301	1	14
Idaho.....	2	13	3	5	3	29
Illinois ²	7	422	15	670	17	1,462
Indiana ²	21	317	21	944	28	1,151
Iowa ²	7	194	14	283	24	999
Kansas ²	7	163	13	284	16	498
Maine ²	4	118	5	214	8	293
Massachusetts ²	5	96	8	205	8	104
Michigan ²	8	124	16	646	25	834
Minnesota ²	14	480	15	711	12	354
Missouri ²	5	24	10	46	11	92
Montana ²	7	115	8	99	11	705
Nebraska.....	7	192	9	811	8	182
Nevada.....						
New Hampshire ²	5	231	7	378	8	455
New Jersey.....			4	70		
New Mexico.....	3	17	3	144	9	69
New York ²	19	263	18	307	26	298
North Dakota.....	10	85	8	120	16	429
Ohio.....	4	190	9	163	19	398
Oregon.....	7	1211	9	272	11	415
Pennsylvania.....	9	56	18	136	28	494
Rhode Island.....			1	17	2	15
South Dakota.....	1	12	7	139	13	740
Utah ²	6	222	8	251	12	373
Vermont ²	4	27	7	158	9	372
Washington ²	5	124	7	164	14	520
Wisconsin ²	11	172	12	293	21	452
Wyoming.....	3	13	6	27	6	18
	201	4,415	281	8,137	396	12,797

¹ Year work started.

² Work started in 1914.

REPORT ON EXTENSION SPECIALIST WORK.

Observations of demonstration methods of extension teaching in the States were made and the best information which the various bureaus have for extension purposes along subject-matter lines was carried to the States. At present the following bureaus and divisions of the United States Department of Agriculture are represented by extension specialists: Soils, Forest Service, Horticulture, Animal Husbandry, and Plant Pathology.

Observations of the methods of extension teaching in extension schools, or short courses, were made in most of the States conducting such schools in the New England, Middle Atlantic, and Central Western States. The methods used in crop and soil improvement were observed in the New England States and in a few of the Central States. A few of the Central States were visited by the extension specialist in horticulture to secure information on orchard improvement demonstrations, and the extension specialist in forestry called upon several extension directors of the Central Western States to promote a greater interest in the farm woodlot, the reforestation of hill and other waste land, and the use of cordwood on the farm in order to increase the use of wood as fuel and to lessen the necessary transportation of coal.

Upon declaration of war with Germany the efforts of each specialist were turned toward food production and conservation methods. The crop specialist centered his attention upon demonstrations which not only improve soils and help to establish profitable rotations but also prove economical in the production of home-raised feeds, especially in the dairy districts: the horticultural specialist sought to increase the yield of vegetables as well as to increase planting by preparing gardening bulletins for the section of boys' and girls' club work; the animal husbandry specialists assisted the State leaders of boys' and girls' clubs in the formation of pig clubs, baby-beef clubs, and poultry clubs, and in disseminating information concerning egg production, wheatless poultry rations, etc.

Through the cooperative efforts of the Forest Service and the States Relations Service, a plan was worked out whereby the forest ranger may serve to a limited degree as the agricultural agent, representing the agricultural college extension division in promoting agriculture on the national forests.

The work of the specialists in carrying the department's information along subject matter lines to the various extension divisions of the States for transmittal to the man on the farm and also in studying and carrying from State to State knowledge of the most efficient organization and practices in extension work along each line, is proving especially helpful as a connecting link between the research

workers of the Federal department and the extension divisions of the States.

The increase in the number of county agents in the States extended the usefulness of the State specialists in that it made it possible for their work to be planned to cover certain counties or groups of counties in which particular agricultural enterprises prevail. The follow-up work was planned by the specialists in cooperation with the agents. The results of demonstrations at particular stages of their development has been made of greatest benefit to the farmers by the specialists, who keep in close touch with agents directly interested in particular lines of work.

One State extension horticulturist selected what were termed criterion orchards whose advancement in foliage, blossoming, etc., indicated the time for applying certain sprays. He had arranged that the owners should telephone to three persons in his belt or district and each of these to three others until all the chain of growers in the district of the criterion orchard had been notified. One specialist arranged with the Weather Bureau for reports to the county agent as to weather forecasts for certain fruit counties where information as to forecasts of frosts and other weather conditions are valuable.

A crop-and-soils specialist and a dairy specialist in one State planned their work together in order to carry on their demonstrations cooperatively. The crop-and-soils specialist considered the needs of the dairy farmer; the dairy specialist considered the crops and soils as limitations to the development of the dairy business. Their instruction at extension schools correlated and their demonstrations in cooperation with the county agents were practicable.

One crop specialist in cooperation with the county agent planned a crop rotation for a large area representing one type of soil in order to raise one variety of wheat particularly adapted to this soil and to raise the kind of legume that would furnish desirable forage crops and at the same time increase soil fertility.

A State and Federal cooperative specialist devised a plan whereby poisoned bait for the killing of ground squirrels and gophers could be distributed and used effectively through a county organization of farmers under the leadership of a county agent.

EXTENSION SCHOOLS.

Extension schools were held in all of the Northern and Western States except five. They varied from 3 to 5 days in length, with 4 days prevailing. A very definite program was usually decided upon after conferences with county agents and subject-matter specialists had been held. The subjects of major importance to a community were chosen and the principal points arranged in sequence and in correlation with points in other subjects.

The work of the specialist is becoming more closely related with the development of the seasonal plan of work of the county agent for the growing season at field-demonstration meetings where small numbers attend for short periods. During the winter and such other seasons as do not interfere with field operations, extension schools are held. In these schools the specialist may again appear before a body of farmers having similar agricultural problems and interests, where the influence of the group concentrates interest in common problems and stimulates the speaker and demonstrator to make practicable application of experiment-station results. Here the specialist has an opportunity to apply his teaching to sound principles of farm management with those who must fit together science and art in the cycle of crop rotation, to increase soil fertility, to increase a maximum production within limits of capital and labor, and to show a reasonable income for management and labor.

From a retrospective view the extension school becomes one feature of a follow-up plan; it looks back upon the work of the productive season; early tillage, liming, drainage, manuring, and commercial fertilizer, and irrigation are discussed from the standpoint of the season's results; breeding associations, cow-testing associations, feeding rations, pastures, and silos are considered from the standpoint of successes and difficulties of the year; seed selection, seed testing, drill adjustment, the establishing of community varieties are presented in the light of seasonal vicissitudes, such as weather, plant diseases, insect pests, and crop yields; animal feeding, the increase of live stock and live-stock management are discussed with reference to feed limitations and factors controlling markets for the year; farm-management problems may be based upon the record of annual outlay and income, labor distribution, and available capital; market problems command attention from the season's production, transportation difficulties of the year past, and the inefficiency of storage facilities.

From the prospective view the extension schools offer an opportunity for directing the community agricultural activities the better to improve every factor not contributing its maximum to the highest possible profitable production of the farm. Coming as they do, in most States, at or near the season when the coming year's plan or program work has been adopted by the farm bureau, it serves to center interest on certain lines of work at the beginning of the year and immediately before the opening of spring field operations and the care of the offspring of live stock.

The attendance at the best extension schools has at no time been very large. This has made possible a more intimate acquaintance with instructors, and has caused less restraint on the part of an auditor to ask questions; acquaintance alone has contributed to

breaking down embarrassments which sometimes prevent individual problems being presented to instructors outside of the sessions.

FARMERS' INSTITUTES AND MEETINGS.

Most of the farmers' institutes in the Northern and Western States are now under the auspices of the agricultural extension divisions. They are usually of one or two days' duration. One or two men, and in most States one woman, take the leading part of the program. Local talent representing some special line of work supplements the program by "State speakers." While the institute program sometimes leans very much toward inspirational presentation and is sometimes colored with entertainment features, there is a gradual drift toward a purely agricultural program for the day sessions, arranged in local cooperation with the county agent. Such institutes in some States are now known as corn, poultry, and dairy institutes. The work done in them by the extension specialists and local speakers is all related to the main subject. Before the week closes a few demonstrators are secured. The work of these persons is followed up during the growing season by both the specialist and the county agent. The institute carried itself beyond inspiration or desultory attention into the real practice of the farmer the following seasons.

The farmers' institute or farmers' meeting has been a popular means during the year for reaching great numbers of farmers who have not the opportunity to attend an extension school, or who do not feel the need of a more intensive presentation either in lecture or demonstration.

SURVEY.

The work of the year has clearly shown the large place which the agricultural extension service now occupies in rural life, and that it is effectively organized to attack the changing problems of the farm. When war was declared most of the States at once looked to the agricultural extension service for leadership in the formulation and direction of a war program for agriculture. The extension departments made such revisions of their programs of work as were necessary to meet the emergencies arising from war, and special and unusual activities were at once inaugurated and carried out with remarkable success. The taking of agricultural censuses and surveys as a basis for the season's activities, the establishment of exchange systems for the sale of seed and live stock, the securing and distribution of farm labor, and the special campaigns for greater crop production and for the preservation of fruits and vegetables, were among the more important of these services. In all of this work the

large usefulness of the county farm-bureau association was repeatedly demonstrated. Where the farm bureau has been thoroughly organized, with able committees in charge of its program of work and local committees in every community, it is the most effective means of reaching the largest possible number of farmers quickly and effectively, and also gives the farmers an organization through which they can act collectively in the many difficulties which will continue to increase during the war.

Although but few home-demonstration agents had been appointed prior to the war, it was at once apparent that for the success of the Government's efforts for the control and conservation of foods technically trained paid local leaders were necessary for educating housekeepers to the new requirements and how to meet them. Many more home-demonstration agents were employed, and plans were made for rapidly expanding the work anticipating the aid of emergency appropriations. Home-demonstration work assumed a new and larger importance.

When the record of agriculture is compared with that of other industries during the first six months following our entrance in the world war, it is evident that the farmers of the Northern and Western States met their new responsibilities and increased production in spite of unusual obstacles, and that this ability to meet unusual conditions was in large part due to thorough organization and the local leadership of the agricultural extension service.

STATE REPORTS.

ARIZONA.

Division of Extension, College of Agriculture, University of Arizona,
Tucson.

E. P. TAYLOR, *Director.*

Organization and administration.—Extension work continued under the same general plan of organization as heretofore. The work was divided into four general groups—county-agent work, home-demonstration work, boys' and girls' club work, and extension specialists. The work was greatly handicapped by the facts that under the State law no county can appropriate more than \$1,000 for county-agent work, and there is no authority for appropriation for other kinds of extension work. The State council of defense assisted in the work by providing funds for the payment of the salaries of two county agents until the Federal emergency funds were available, by cooperating in making an agricultural survey of the State, and by furnishing forms for silo construction. A two-day agricultural mobilization conference was held by the extension service at Tucson

early in April. This was the first State-wide gathering of the leaders in agricultural work called after war was declared, and the conference brought forth many sound suggestions and concrete plans for increasing food production.

Publications.—Two circulars, 19 food and conservation posters, and 3 war-garden circulars were issued during the year. The weekly press letter was sent to the newspapers of the State as heretofore.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal -----	\$13, 145. 03
Smith-Lever, State -----	3, 145. 03
United States Department of Agriculture:	
Farmers' cooperative demonstration work -----	5, 268. 82
Bureau of Biological Survey -----	1, 000. 00
State appropriations -----	1, 886. 17
County -----	3, 640. 40
Other sources within the State -----	1, 418. 89
<hr/>	
Total -----	29, 504. 34

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, extension schools, live-stock extension work, and Egyptian cotton extension work. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, boys' and girls' club work, and control of mammal pests.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County agent work.—Number of counties covered by agents—June 30, 1916, 6; June 30, 1917, 7. The extension director acted as county-agent leader. One of the principal aims of the county agents was to have Arizona produce as nearly as possible all the foodstuffs consumed in the State. With this in view gardening, poultry raising, the growing of wheat substitutes, the growing of sweet sorghum from which to make molasses, dairying, and stock raising were emphasized. One of the noteworthy achievements of the agents was the bringing about of the building of 137 silos during the year.

Among the principal results of the work were the following: Five hundred and sixty-five acres of alfalfa were sown; 65 orchards, including 17,655 trees, were cared for following agents' suggestions; 1,095 cows were under test in associations organized by agents, resulting in 140 cows being discarded as unprofitable; and 935 animals were treated for blackleg. Fifty-six boys' and girls' clubs, with a total membership of 657, were organized and supervised by the

agents. Seven hundred and twenty-four demonstrations, involving 880 live stock, and 1,423 acres of crops, were arranged for and supervised.

As special war activities, the extension service, through the county agents, cooperated with the Arizona State Council of Defense in making an agricultural survey of the State and farm labor and farm machinery surveys. The agents assisted farmers in obtaining seed, and crop and live-stock production were stimulated; the bean campaign alone resulting in an increase of 2,611 acres and 28,671 bushels produced.

The agents made 6,126 farm visits, and held 596 meetings, with a total attendance of 27,760 persons during the year.

Home economics.—A home-economics specialist was appointed January 1, 1917, and worked alone until September, 1917, at which time two county demonstration agents were appointed. Before the appointment of the county demonstration agents, the work was carried on through extension schools and home-economics clubs and in individual homes with the assistance of local leaders. Instruction was given in better housekeeping methods, better cooking, and practical sanitation. As soon as war was declared an effort was made to take care of the surplus fruit and vegetables in the agricultural valleys, and to distribute the preserved products in the mining sections of the State. Food-saving committees were organized in each county, and perishable foodstuffs were conserved. This was the beginning of the State-wide campaign for "Arizona to feed herself." After September 1, 1917, war gardens, poultry raising, the preservation of foodstuffs, and the care of milk in the home were given State-wide attention by the emergency home-demonstration agents.

The most important achievement was demonstrating that milo-maize flour could be used as a substitute for wheat flour in all kinds of quick and yeast breads. The chief mill owners of the State were also induced to manufacture milo-maize flour. It is impossible to estimate the commercial value of this demonstration to the State, as the use of milo maize will do much to stimulate food production, will increase the profits of the dry-land farmers considerably, and will reduce the need of importing cereals from other States. The home-demonstration agents also have given special attention to the cooking of the frijole and tepary beans, two products successfully grown in a semiarid climate.

Boys' and girls' club work.—The work was conducted by a State leader, 7 assistant and district leaders, and 74 unpaid volunteer local leaders. Eight projects were carried out, of which 7 were completed. In the complete projects were 142 club groups.

Fifty-four canning demonstrations were given by club members with a total attendance of 2,617 club members and men and women. Eighty-one field demonstrations, 7 club fairs and festivals, and 17 local club exhibits were conducted during the year. The eight club leaders personally visited 663 club plats.

The following table shows some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Number of clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	6	16	11 acres.....	269.5 bushels..	\$721.20	\$200.42
Potato.....	2	4	0.6 acre.....	134.2 bushels..	241.56	43.17
Home garden.....	60	231	3.76 acres.....	.....	891.80	159.87
Grain sorghum.....	3	9	.....	8,868 pounds..	310.38	92.30
Poultry.....	10	56	198 fowls.....	924.75 dozens..	443.88	341.67
Pork and crop.....	24	164	119.....	13,278 pounds..	2,602.53	1,116.50
Canning.....	37	283	.....	13,753.5 quarts, 204 jars jelly.	4,401.12	1,186.20
Total.....	142	703	.....	.....	9,612.47	3,140.13

Total club enrollment, 1,527.

Extension schools.—Extension schools lasting from two days to a week were held at 10 different places during the year with a total attendance of 6,309, representing about 1,500 families. A farmers' and housekeepers' week, attended by 144 women and 106 men from all parts of the State, was held at Tuscon.

Live-stock extension.—The live-stock extension specialist during the year did work along the lines of dairy improvement, range-cattle improvement, range sanitation, and miscellaneous work consisting of assisting county agents, blackleg and screw-worm eradication, and poisonous plant investigations. In the dairy work two cow-testing associations were reorganized with 1,056 cows under test. A large number of the members of the old associations continued in the new organizations. In sections where associations were not practical, the keeping of individual herd records was encouraged and 33 dairymen were furnished with milk, breeding, and feed-record sheets. These records resulted in a considerable number of boarders being weeded out of herds. In one case a farmer found that 6 of his 11 cows were not paying for their feed. Considerable work was done in bringing about better management of range bulls. Five cooperators kept their bulls in separate pastures during all the year except June, July, August, and September. This was only the second year of this line of work, and the value of it is not yet manifest. The work in range sanitation which was begun in January, 1916, was continued. The two ranchmen who began cooperating at that time by destroying the

carcasses of animals dying of blackleg reported that, during the season of 1917, they had had no outbreak of blackleg on their ranches, and that the screw worms were not so bad as in previous years. Five other stockmen are known to have burned or buried all carcasses found upon their ranches during 1917.

Considerable difficulty has been experienced in bringing about improvement of bull management and the destruction of carcasses on public ranches. Sixteen blackleg-vaccination demonstrations, attended by 121 stockmen and at which 3,091 animals were vaccinated, were given by the extension specialist upon the open range under the same conditions that stockmen must work. Seven screw-worm demonstrations, attended by 37 stockmen, were held. Several meetings were held in the northern part of the State, at which information was given regarding poisonous plants, their control, and the treatment of animals poisoned. The specialist assisted in building 15 movable hog houses and organizing a Duroc-Jersey breeders' association with 35 members. He gave 90 lectures, made 32 demonstrations, judged live stock at 5 fairs, and assisted in the purchasing of 14 pure-bred hogs, 201 pure-bred Herefords, 56 pure-bred Holsteins and Jerseys, 37 grade heifers, and 4,500 range cattle.

Egyptian cotton extension.—Owing to the resignation of the specialist early in the season very little was done on this project.

OTHER EXTENSION WORK.

Entomology.—Demonstrations in poisoning grasshoppers and other methods of controlling them were carried on by the extension service, Bureau of Entomology of the United States Department of Agriculture, and the State entomologist. In Navajo and Apache Counties campaigns were made for better orchard spraying. The apple orchards that were sprayed yielded crops 75 to 95 per cent free of codling moths, while in the unsprayed orchards only 2 to 15 per cent of the fruit was worm free.

Control of mammal pests.—Four field parties were organized in cooperation with the Bureau of Biological Survey of the United States Department of Agriculture for the purpose of exterminating prairie dogs in infested areas in several of the National Forests. One hundred and forty-two thousand acres were cleared of these pests at a cost of 3 $\frac{3}{4}$ cents per acre. The annual loss previously suffered by the farmers on the treated areas was \$70,000, and it was estimated that the reclaimed areas when the grass has become reestablished will furnish grazing for 6,117 more cattle than heretofore. A drive on jack rabbits was made near Casa Grande, where the rabbits during the previous summer had destroyed more than \$40,000 worth of cotton.

Marketing.—The extension service, the Bureau of Markets of the United States Department of Agriculture, the Maricopa County marketing and developing committee, and the University of Arizona cooperated in making a detailed survey of the marketing conditions in the Salt River Valley.

Special advisory service.—Special assistance was given by the extension service, the State college of agriculture, State experiment station, and the United States Department of Agriculture along various lines not covered by any project. This assistance was given in answer to calls made from different parts of the State, and included help in botany, irrigation, engineering, horticulture, plant breeding, agronomy, animal husbandry, and poultry raising. An orchard pruning demonstration was given in each of the following counties, Yavapai, Santa Cruz, and Cochise.

Fairs.—The extension service made an exhibit at the State fair showing the work of the State experiment station, boys and girls' club work, county home-demonstration work, county-agent work, including seed and cow-testing work, and Arizona wool. A demonstration was also given showing the methods used to control rodents. Members of the extension staff acted as judges for live-stock and agricultural and home economics products at many fairs held in the State and the county agents and other extension workers assisted in collecting products and arranging exhibits at these fairs.

SURVEY.

The State council of defense rendered valuable assistance by providing funds to employ agents, by assisting in the agricultural survey of the State, and by furnishing forms for silo construction. The success of the county agents in increasing the food supply of the State demonstrates the value of the surveys when abnormal conditions arise. The home-economics workers rendered a lasting benefit to the State by their demonstrations on the use of milo-maize flour, food preservation, and the care of milk. The achievements of the boys' and girls' clubs in food production and conservation are noteworthy. The increase both in the number of boys and girls enrolled and the percentage who completed the work show the growing interest in this line of work. The efforts of the live-stock specialist to bring about better range management and sanitation and to improve dairy herds will materially aid both the stockmen and the dairy men. The work of the county agents and the Biological Survey shows what can be done in mammal pest control at small cost when there is hearty cooperation. The extension workers, as a whole, did much to aid the State in taking a long step toward feeding itself.

CALIFORNIA.

Division of Agricultural Extension, University of California, College of Agriculture, Berkeley.

W. T. CLARKE, *Director*.

Organization and administration.—No important changes were made during the year. The relationship of the extension division to the other divisions of the college of agriculture were greatly strengthened and were of constant service in meeting the problems under war conditions. All divisions of the college of agriculture were mobilized for war work and were active in extension work of all kinds. Cordial cooperation was maintained with the State and county councils of defense and with other State departments. The necessity of a clearer definition of the functions and relationship between the county horticultural commissioners and the county agents has become apparent and is receiving consideration.

Publications.—The bulletins and circulars of the State experiment station and the United States Department of Agriculture are regularly used in extension work, but during the past year 14 leaflets have been issued as extension publications and used to further food production in the war emergency.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$30, 235. 33
Smith-Lever, State	20, 235. 33
United States Department of Agriculture, farmers' co-operative demonstration work	11, 564. 92
Bureau of Biological Survey	700. 00
Bureau of Animal Industry	4, 436. 74
County appropriations	26, 000. 00
College	17, 140. 44
Total	110, 312. 76

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, and farm-management demonstrations. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, boys' and girls' club work, farm-management demonstrations, control of mammal pests, and hog-cholera work.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties covered by agents June 30, 1916, 13; June 30, 1917, 17. The work was supervised by a county-agent leader with one assistant.

The following were some of the more important results of the work: Four hundred and twenty-five farmers were encouraged to treat their seed oats for smut, resulting in 29,722 acres being sown with treated seed; 604 orchards were cared for according to methods recommended by agents, principally for the control of insect pests and fungus diseases on 196,850 trees; 5 cow-testing associations were organized and 16,327 cows were under test in associations, resulting in 585 cows being culled out as unprofitable; 3,075 animals were tested for tuberculosis; 1,577 animals were treated for blackleg; and 13,380 hogs were vaccinated for cholera at the suggestion of agents. It is estimated that the 58 irrigation systems planned by the agents will bring 82,320 acres under irrigation. The farmers' exchanges and other purchasing and marketing associations organized by the agents did nearly \$750,000 worth of business during 1917, and saved the farmers more than \$50,000. The agents arranged for and supervised 764 demonstrations, involving 22,414 acres of crops and 1,876 head of live stock.

When it became apparent that war was imminent, confidential surveys were made anticipating work to increase production to meet the war needs. These indicated the counties where increased production was feasible, and 6 itinerant assistant county agents were used in those counties, partly to help stimulate an increased production of crops and live stock to meet the war needs, and partly that the men might be trained for work in counties without agents. In order to bring before the people of the State the importance of having county agents in all agricultural counties, 19 members of the faculty of the college of agriculture volunteered to assist in a campaign of education. Each was assigned to a county to acquaint the people with the work of county agents, and to explain how one might be secured. The aim in California is to place an assistant county agent in all counties having more than 1,500 farmers.

Several State-wide campaigns were conducted. A grain-sorghum campaign resulted in increasing the acreage of this crop 29,918 acres; the bean acreage was increased 13,814 acres, thereby increasing the production 212,300 bushels; the farmers of the various counties were assisted in securing 28,737 bushels of spring wheat for seed and the campaign resulted in an increase of more than 100,000 acres of wheat sown. The quota of increased acreage of wheat asked by the Federal Government of California was about 80,000 acres, of which 44,075 acres was assigned to counties having county agents. The farmers in these counties, however, actually signed agreements to sow 101,470 additional acres of wheat, doing it mostly by transferring one-tenth of their barley acreage into wheat. Sheep to the number of 7,530 were placed on farms, as a result of efforts made to increase live-stock production. The agents assisted in organizing 53 farm-loan associa-

tions, and secured 2,989 male laborers and 1,326 female laborers for the farmers. One hundred and two canning demonstrations were held for adult women, resulting in more than 40,000 additional quarts of vegetables and fruits being canned. The agents made 13,169 visits to farms, gave information at their office to 22,761 farmers, took part in more than 5,000 meetings, which were attended by more than 100,000 people. The farm bureaus supporting the work and cooperating with the agents had a membership of 8,578.

Home economics.—Prior to June 30, 1917, there was only one home-economics leader and an assistant for the State. Nine district agents were appointed in September, 1917, to carry out a food-conservation program, which included demonstrations in canning fruits, vegetables, and meats, and in the preparation of foods as substitutes for wheat and meat. The work was presented chiefly through the county farm bureaus and the State federation of women's clubs. The State and county libraries furnished books and bulletins to women interested in home-economics study. The purpose of the work during the greater part of the year was to present to farm women new methods of housekeeping designed to lessen drudgery and to increase the farm income. The program included lecture demonstrations in canning, jelly making, sanitation, and the proper preparation of meals. The instruction in the canning of meats was particularly valuable in the sparsely settled regions. Fifty-six farm-women's clubs were assisted with programs and formed an important educational agency. The household conveniences specially emphasized were the fireless cooker and the septic tank. As a result of the demonstrations of the practicability of the latter, 111 tanks were installed in one county. Thirty-nine of the 58 counties of the State were reached during the year. The attendance at demonstrations was over 12,000. Exhibits and demonstrations were given at county and district fairs. In the first three months of duty the emergency demonstrators gave 364 demonstrations before 317 organizations.

Boys' and girls' club work.—The boys' and girls' club work was conducted by a State leader and two assistants. Fifteen high-school teachers of agriculture acted as local or district leaders, receiving salary for this work during the three summer months. The club work continued to be largely with high-school students. Each member of the high-school clubs was visited once each month on the home farm during the crop-growing season, 2,047 members being thus visited during the year, and each club group was visited each month during the school session. In this way about 87 per cent of the club members enrolled completed their work and made final reports. With the development of the high-school movement, the high-school club members became desirous of organizing elementary-school clubs in the surrounding country and have exercised supervision over such

clubs. During the past year 107 of these elementary-school clubs were organized with 820 boys.

Eight subject-matter projects were carried out during the year. Two hundred and thirty-eight club groups were organized with a total enrollment of 1,811 members. Products having a total value of \$31,974.35 were reported, produced at a cost of \$13,404.42. During the year 34 field demonstrations, 108 club fairs and festivals, and 105 club exhibits were conducted. The club leaders visited 3,275 club plots, and the club members were assisted in their work by the use of 61,000 copies of follow-up instructions prepared and sent out by the State.

Some of the more important facts regarding the club work are shown in the following table:

Summary of completed projects of boys' and girls' clubs.

Project.	Number of clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	10	21	24 acres.....	812 bushels.....	\$1,407.40	\$360.53
Potato.....	64	312	70 acres.....	8,354 bushels.....	10,859.00	4,622.24
Home garden.....	9	31	1,260 square rods.	.....	1,067.52	372.28
Bean.....	28	110	46½ acres.....	45,635.5 pounds...	3,690.75	1,243.34
Grain sorghum.....	38	180	91½ acres.....	173,122.9 pounds...	5,050.95	1,568.78
Onion.....	10	32	2 acres.....	13,126 pounds.....	283.11	123.60
Poultry.....	16	24	179 fowls.....	715 chicks, 227 dozens eggs.	539.09	190.85
Pork and crop.....	63	205	443.....	67,618.93 pounds...	9,076.53	4,982.79
Total.....	238	915	.....	.....	31,974.35	13,404.42

Total club enrollment, 1,881.

The Bureau of Animal Industry of the United States Department of Agriculture cooperated in this project.

Farm-management demonstrations.—Farm-management demonstration work was undertaken for the first time in the State under the direction of a demonstrator. Special attention was given to showing farmers how to keep simple farm accounts in order better to study their farm business. Through county agents and farm-management demonstrators, 643 farmers in 10 counties were assisted to start accounts. As a result of farm-management demonstration work, 48 farmers were reported as having modified the management of their business in order to increase their labor incomes.

OTHER EXTENSION WORK.

Specialists.—A number of extension specialists were employed under funds appropriated by the State. They worked with the county agents when invited to do so and with farmers' organizations

in other counties. They did both lecture and demonstration work. These men also gave considerable attention to visiting and advising farmers personally. The many new settlers in the State have their own peculiar problems, which usually can be solved best by an actual visit and study on the part of a specialist. Often this involves advice as to the value or use of land which it would be impolitic for the county agent to give. This service was of great benefit to new farmers and was given in some 500 cases, which involved an examination of more than 100,000 acres of land during the year.

Extension schools and train.—Two extension schools were held, with an average daily attendance of 69. An agricultural preparedness train was operated in cooperation with the Utah Agricultural College and the University of Nevada and the San Pedro, Los Angeles & Salt Lake Railroad during May. The train spent one day at each stop and was visited by 55,000 persons.

Farmers' institutes and special lectures.—Farmers' institutes were held in the counties which did not have county agents when the farmers petitioned for them. Twenty 1-day and five 2-day institutes were held, with a total attendance of 1,843. During the past few years there has been a tendency for farmers' institutes to become more specialized, and a few special institutes were held during the year at which only one subject was discussed. Thus, a fig institute, consisting of five meetings, was held, at which was discussed the various phases of the fig industry. There was an average attendance of about 350 at each session. Under the auspices of the extension division members of the staff have given 430 special lectures before meetings of agricultural organizations, the total attendance being 33,938.

SURVEY.

The "community-center" idea in county-agent work, which has developed in California from the first, has served to develop local initiative, and, through the regular meetings provided for at these centers, people have found expression and the Federal and State plans for crop production and conservation have been made known. The principle of starting no work which can not be supervised adequately is to be commended. This applied to boys' and girls' club work resulted in the enrollment being kept down and in the work being completed by a greater percentage of those enrolled.

The response to war needs was prompt and effective, the entire college staff being available to the extension service for use so far as possible in promoting county organization for increased crop production and food conservation.

COLORADO.

Division of Extension Service, State Agricultural College, Fort Collins.

H. T. FRENCH, *Director*.

Organization and administration.—No important changes have been made other than to increase the staff by the employment of a State leader of county agents.

Immediately upon the declaration of war steps were taken to meet the demand for assistance in food production and conservation through the cooperation of the extension service with the State and National authorities. In cooperation with a committee on emergency work, appointed by the president of the State agricultural college, the State was divided into districts and four instructors from the college were appointed for field work. Their special duty was to assist in seed distribution, to advise with local authorities in the use of farm tractors, to assist in securing labor, and, above all, to organize the counties as far as possible and interest the farmers in securing county agents. The work of these men paved the way for more thorough subsequent organization and the employment of emergency demonstration agents.

Publications.—Within 10 days after the emergency food call came a bulletin, entitled "We are Facing a Food Shortage," which was prepared and mailed to farmers and rural-school teachers in an edition of 20,000 copies; 13 extension bulletins with more than 70,000 copies were published during the year; 476 articles were furnished the press, including a number of special extension stories.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$18, 786. 47
Smith-Lever, State.....	8, 786. 47
United States Department of Agriculture, farmers' cooperative demonstration work.....	12, 746. 51
Bureau of Biological Survey.....	200. 00
Bureau of Markets.....	300. 00
State appropriations.....	1, 100. 00
County.....	8, 581. 83
Other sources within the State.....	159. 40
Total	50, 660. 68

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' clubs, farm-management demonstrations, animal husbandry, and marketing. Funds from the United States Department of Agriculture were used in the support of the following projects: County-

agent work, home economics, boys' and girls' club work, farm-management demonstrations, marketing, and control of mammal pests.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents June 30, 1916, 19; June 30, 1917, 16. The work was supervised by a county agent leader. The reduction in the number of counties covered by agents is due to the fact that one district, including 5 counties, covered by one agent, was considered too large, and the agent, therefore, was assigned to only one county. The agent in Kit Carson and Lincoln Counties was assigned to Kit Carson County for the same reason. Three new counties appointed agents during the year.

The following are some of the results of the work of the agents during the year: Two hundred and sixteen farmers were induced to select seed corn, resulting in 4,894 acres being sown with fall-selected seed; 214 farmers treated their seed oats for smut, the average increased yield due to treatment being about 14 bushels per acre on a total of 6,405 acres; 229 farmers treated their seed potatoes at suggestion of agents, the average increased yield due to treatment being approximately 9 bushels per acre on a total of 2,205 acres; 227 registered rams were secured; 1,059 animals were treated for blackleg, and 298 silos were built on suggestion of agents or under their direction; 198 boys' and girls' clubs, having a membership of 2,300, were organized and supervised. Through the prompt action of the county agents at least 2,930 acres of crops, principally alfalfa, were saved from grasshoppers, and nearly 2,000 acres of agricultural land were cleared completely of prairie dogs. The agents arranged for and supervised 575 demonstrations, involving 10,175 acres of crops and 1,988 live stock.

In addition, the agents carried on several definite campaigns to increase crop and live-stock production and to aid in food conservation, resulting in the sowing of 22,357 acres of wheat, increasing the production of spring wheat alone approximately 146,622 bushels; the corn acreage was increased by 10,672 acres, thereby increasing the production 162,556 bushels; 6,908 bushels of seed potatoes were secured for farmers and the potato acreage was increased by 3,983 acres, increasing the production practically three-quarters of a million bushels; 902 farmers were assisted in securing 2,465 bushels of seed beans, and the bean acreage was increased by 18,830 acres, making an increase in production of about 103,245 bushels.

Through the influence of the agents 321,450 sheep were placed on farms and 350 horses were located for the United States Army; 2,877 laborers were furnished to farmers through agents or farm-

bureau offices, and 695 farmers were given assistance in securing credit for purchasing seed, machinery, etc. Twenty-six farm-loan associations were organized with the assistance of the agents; 133 canning demonstrations were held, and it is estimated that 111,450 quarts of vegetables and fruit were canned by adults as a result of work of the agents, exclusive of regular boys' and girls' club work.

The agents made 5,632 farm visits, received 11,589 calls at their offices, held 1,667 meetings, attended by 84,946 persons. Three hundred and sixty-four of these meetings or demonstrations were attended by specialists of the State agricultural college or the United States Department of Agriculture.

Home economics.—A home-economics leader and two assistants gave instruction to women during the year through 27 extension schools, institutes, club meetings, and personal visits to 282 homes, reaching a total of 7,000 women. Before January 1, 1918, two home-demonstration agents had been installed in districts and one in a county. Fifty-two clubs, with a membership of 1,500, received regular assistance with their home-economics work in the form of programs and study helps. A model of an efficient kitchen, arranged to save steps and labor, was exhibited at the college during farmers' week. The demonstrations at extension schools were adapted to local conditions: In the dry-land section such housing problems as ventilation, storing in 1-room houses, and practical ways of enlarging the homesteader's shack were discussed; in the fruit sections, discussions of the value of fruit in the diet and canning demonstrations were given. A special campaign was made to increase the number of water systems in farm homes, from the belief that an abundance of water in the house, even with the simplest and most inexpensive equipment, is essential to the success of any propaganda for improved living conditions.

The head of the home-economics department in the State agricultural college has charge of the urban work organized in Denver and Pueblo in cooperation with educational and other agencies. A home-demonstration agent in each city has taught war cookery to organized classes by demonstrations, with 10 lessons in each course, laying special stress on the use of local products, such as emmer, as a substitute for wheat.

Boys' and girls' club work.—Nine projects are now carried on by the boys' and girls' clubs of Colorado—viz. cooking, sewing, gardening, canning, poultry, pig, corn, potato, bean, and cow testing. The plan of the work is progressive, being arranged in a sequence covering three years. Eleven persons were employed in supervising the club work in 10 counties, most of them being teachers employed by the school board or community. There were also 214 voluntary club leaders who met their members from 1 to 4 times a month. The pig-

club work was supervised by a specialist in cooperation with the Bureau of Animal Industry, United States Department of Agriculture. Four hundred and fifty-five club groups were organized, with a total enrollment of 3,637. The total value of products was reported as \$45,049.38 and the cost of production as \$16,726.14. During the year 225 canning demonstrations, 58 field demonstrations, 44 club fairs and exhibits, and 23 local exhibits were held. At the canning demonstrations there was an attendance of 7,425 club members, women, and men. A special contribution for war emergency food production and food conservation was made by the boys and girls in Colorado, who put up 15,728 jars of fruits, vegetables, meats, soups, and jelly during the year. These canned goods were reported to have had a value of \$4,780.45 in addition to the value of the products reported under the head of completed projects.

One county agricultural agent reported 50 farmers in his county growing potatoes who became interested in the crop through the potato clubs.

Some of the more important items regarding the complete projects are given in the following table:

Summary of completed projects of boys' and girls' clubs.

Project.	Clubs organized	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	69	172	172 acres.....	5,031 bushels..	\$9,156.42	\$2,184.40
Potato.....	43	157	24 acres.....	4,108.8 bushels.	4,314.24	1,070.40
Home garden and canning.....	69	605	20,570 square rods.	15,577 quarts; 151 jars jelly.	19,148.25	6,101.89
Bean.....	24	55	55 acres.....	16,500 pounds.	1,526.25	676.50
Poultry.....	58	166	.....	2,158 chicks.	1,826.00	511.28
Pork and crop.....	51	126	126.....	20,601 pounds.	3,605.17	1,493.57
Garment making.....	110	573	.....	2,292 pieces.	3,917.85	3,917.85
Cooking.....	31	162	.....	7,776 dishes.	1,555.20	770.25
Total.....	455	2,016	.....	.....	45,049.38	16,726.14

Total club enrollment, 3,637.

Farm-management demonstrations.—Four additional counties took up the work during the year, making a total of 11 counties conducting the work. County agents and the farm-management demonstrator started 200 farmers studying their business through simple farm accounts. Farm-analysis records were taken on 93 farms. These records and 71 taken the previous year were summarized and returned personally to farmers. As a result of studying their business 80 farmers changed their management with the view of effecting larger labor incomes.

Animal husbandry.—A specialist in animal husbandry was appointed during the year, who judged live stock at 10 county fairs and gave instruction to 13 extension schools. Special instruction was

given on how to properly utilize local crops in a balanced ration. A silo campaign was conducted throughout eastern Colorado in June with a total attendance of 5,356, the pit silo being given special emphasis. All but one of the county agents were visited, given assistance, and furnished with a plan for a hog-feeding demonstration. Assistance was given in the control of animal diseases, especially hog cholera, by a veterinarian and assistant employed by the Bureau of Animal Industry of the United States Department of Agriculture.

Marketing.—Extension work in marketing was organized in cooperation with the Bureau of Markets of the United States Department of Agriculture. A special appropriation was made by the Colorado war council and an office of markets was located in Denver with an agent in charge and five assistants, including specialists in commercial canning, evaporating and dehydrating, storage, and transportation. In addition to furnishing the regular Daily Market News Bulletin, this office made studies of the marketing of Colorado poultry and dairy produce and of the products of the San Juan Valley. Through the assistance of this office the Colorado Bean Growers' Association was organized and some five county bean growers' associations affiliated with it. A marketing committee was appointed in each agricultural county to cooperate with and report to the State marketing committee of the governor's war council. A general survey of marketing conditions, methods, facilities, and needs was conducted throughout the State.

SURVEY.

The employment of agents for districts embracing several counties each has been tried and was abandoned during the year. The employment of an agent for an area not exceeding one county has resulted in most satisfactory service.

The home-economics work, although modified to meet war conditions, continued and pushed the prewar campaign for introducing running water in the home. The selection of one essential home convenience as a leader has made possible the introduction of other phases of home improvement. Success seems to have been attained in adapting the instruction and demonstrations to the needs of rural people. The practical nature of the club work undertaken under adequate leadership and the record of results secured promises well for future work of the boys and girls.

The marketing problems of the State were met through the efficient work of the office of markets located at Denver, and the farmers receive their greatest encouragement to continue crop production through their ability to sell the crops to advantage. The office of markets has rendered valuable service in this respect, and its continued usefulness is assured.

CONNECTICUT.

Division of Extension Service, Connecticut Agricultural College, Storrs.

H. J. BAKER, *Director*.

Organization and administration.—No change was made in the plan of organization during the year other than the addition of an extension agronomist to the staff.

At the request of the committee of food supply of the State council of defense the extension service opened an office with the committee at Hartford. The county agent leader undertook the correlation of the work of the committee and the extension service, and as a result the extension service and the county farm bureaus eventually assumed responsibility for a large share of the work. Under the direction of the girls' club leader the work of the women's organizations of the State was correlated, and later the leader was appointed chairman of the State women's committee and the representative of the United States Food Administration. The publicity and the marketing and the cooperative organization problems of the food committee were also handled by an extension-service representative.

On June 30 each of the 7 counties in the State had a farm bureau, a county agent, and a home-economics demonstration agent. Besides these there were 9 emergency food agents, 5 assistant county agents, 3 county-club leaders, and 3 general secretaries of farm bureaus. The extension service has emphasized the need of an administrative head in each farm bureau, and in four counties the county agents perform such duties and in two others general secretaries have been employed.

Publications.—Four bulletins and seven circulars—one a joint circular with the experiment station—were published during the year.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal.....	\$12, 561. 53
Smith-Lever, State.....	2, 561. 53
United States Department of Agriculture, farmers' co- operative demonstration work.....	8, 873. 74
Bureau of Animal Industry.....	1, 615. 84
State.....	11, 640. 64
County.....	37, 812. 23
Total.....	75, 065. 51

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, boys' and girls' club work, farm-management demonstration work, poultry demonstrations, and dairying. Funds from the United States Department of Agriculture were

used in support of the following projects: County-agent work, boys' and girls' club work, home economics, farm-management demonstrations, and dairying.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents June 30, 1916, 7; June 30, 1917, 8. The extension director acted as county-agent leader. Every county in the State now has a farm bureau with one or more paid agents. On December 1, 4,149 members in the farm-bureau associations were cooperating with the agents.

Among the principal results of the work in 1917 were the following: One hundred and thirty-six farmers cooperated in growing soy beans; one cow-testing association was organized, and 2,221 cows were under test in this association and in associations organized by the agents in previous years; 2,322 hogs were vaccinated for cholera by veterinarians or farmers at suggestion of agents; 1,037 tons of lime and limestone were used to correct soil acidity; \$342,000 worth of business was done during the year by associations organized with the assistance of the agents, and this resulted in a saving of \$44,600 to the farmers. Seventy-six boys' and girls' clubs were organized, with an enrollment of 2,881. The agents arranged for and supervised 295 demonstrations, involving 495 acres of crops and 2,110 live stock.

In addition, the agents devoted a large part of their time to stimulating increased food production. As a result of special campaigns, 2,225 bushels of seed potatoes were secured for farmers, the potato production was increased 150,000 bushels, and 96 farmers were assisted in securing seed beans. To stimulate food conservation, 232 canning demonstrations were held for adult women. As a result of work of agents, exclusive of club work, the amount of vegetables and fruit canned in the State was increased by nearly 200,000 quarts. Thirty-six thousand five hundred pounds of vegetables and fruit were dried as a result of a special campaign. Eight hundred and five laborers were secured for farmers through the offices of county agents.

In carrying on the work the agents made 4,697 farm visits and took part in 1,074 meetings, attended by 46,158 persons.

Boys' and girls' club work.—Seven subject-matter projects were carried on during the year, namely: Corn, potato, home gardening, canning, poultry, bread, and garment making. A total of 170 club groups were organized during the year, as against 61 clubs organized in the preceding year. These 170 clubs show a total enrollment of 12,578 club members. An assistant State leader was appointed in the spring of 1916, and about 25 paid local leaders were employed for

four or five months. The total value of all products reported was \$100,494.50, and the cost of production \$77,791.38. Special attention was given to the home-garden project, which had a total enrollment of 11,572 members, who reported \$91,791.76 worth of fresh vegetables produced. As a means of follow-up work and project direction, 82,900 copies of follow-up instruction were distributed.

The chief items of interest regarding the completed projects are given in the following table:

Summary of completed projects of boys' and girls' clubs.

Project.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount produced.	Estimated value.	Estimated cost.
Corn.....	1	51	27 acres.....	1,312.3 bushels.	\$2,643.98	\$1,242.92
Potato.....	2	45	8.75 acres.....	1,385 bushels..	1,944.78	716.62
Home garden.....	126	7,955	22,802 square rods.	.....	91,791.76	73,335.18
Poultry.....	8	70	672.....	1,942 chicks, 3,889 dozen eggs.	2,364.44	1,415.17
Home canning.....	8	75	.....	5,242 quarts, 521 jars jelly.	1,575.34	971.66
Bread.....	3	5	.....	285 loaves.....	57.00	34.20
Garment making.....	22	108	.....	390 pieces.....	117.20	75.63
Total.....	170	8,309	.....	.....	100,494.50	77,791.38

Total enrollment, 12,578.

Farm-management demonstration.—Special attention was given to pressing agricultural economic problems during the year. The demonstrators, in addition to their regular work, assisted in studying the farm business on 42 poultry farms and the cost of producing milk on 174 dairy farms. A simple account book with provision for making short-time loans was published. Intensive demonstration work was continued with a single farmer in Litchfield County—"Smith of Litchfield." Farm-analysis records were summarized and personally discussed with 140 farmers, 144 farmers were assisted in starting simple farm accounts, and 43 men were aided in keeping accounts throughout the year.

Poultry.—A poultry survey was made by the college poultrymen and the farm-management department of the extension service. It showed that egg production per hen and feed cost were the most important factors in profitable poultry production. Eighty-five poultry meetings were held with an attendance of more than 1,560 people, each one of whom received personal instruction in how to cull his flock. The demonstrations at these meetings showed that about 46 per cent of the hens examined were unprofitable producers. Growing feed and better selection of stock, more careful management, and

more judicious feeding and housing were emphasized during the year.

Dairying.—A cost-of-milk-production survey was carried on covering the year ending April 30, 1916. This survey covered 178 farms and was the most important piece of work done in dairying. It showed that the average production per cow was 6,009 pounds, the average cost of producing milk 5.53 cents per quart, and the average price received 4.87 cents per quart. The published results of the survey have served as a basis in many localities in considering the prices of milk during the succeeding year. Cow-testing associations received considerable attention but were not especially successful, due to the fact that competent testers were difficult to obtain because of the low salaries paid and the fact that dairymen are more interested in producing market milk than cream. In some counties the cow testers were put on the farm-bureau staff, the farm bureau paying a small portion of their salaries. Educational milk, cream, and butter-scoring exhibits were continued, but relatively few dairymen took advantage of them. Herd-record work increased rapidly during the year. Demonstration herd work also proved valuable in the few communities where it was possible to carry it on.

OTHER EXTENSION WORK.

Home economics.—At the close of the calendar year 1916 the home-economics extension workers employed in the State consisted of a leader on part time and two assistants. A year later there was a full-time leader, an assistant, and 15 emergency home-demonstration agents, there being an agent in each county and six emergency agents in counties having large cities. Prior to the war the home-economics work was principally that done by extension workers in nine extension schools.

The first work undertaken in connection with the war emergency was the organization of 7 one-week training schools, in which over 500 volunteer women workers were trained to give instruction in canning and drying. About 25 community canneries were established; 17 of these reported 54,000 cans of food preserved. The amount of food canned at home was probably as great as that canned at the centers, as two communities reported over 8,000 jars of fruit and vegetables canned at home. The women in one county put up 7 tons of jam and jellies which, after being exhibited at a county fair, were shipped to hospitals in France.

Extension schools.—Nine extension schools were held during the year and courses given in poultry husbandry, dairying, crops, and home economics, instructions being given by the extension-service workers. These schools stimulated community interest and coopera-

tion in rural improvement, and prepared the way for such lines of extension work as were felt to be needed.

Farmers' institutes.—Thirty-one farmers' institutes were held, with a total attendance of 1,669 persons. Eighty-eight lectures were delivered, 62 being given by members of the extension and experiment-station staffs and the remainder by farmers and others not connected with the college.

Fair exhibits.—Educational exhibits and demonstrations were made and information was given out at the principal fairs of the State by members of the college and extension staffs.

Agronomy.—Especial attention was given to increasing acreage in farm crops. Four soil management cooperative projects were carried on by specialists and county agents and a reconnoissance of the soil and crop conditions was made preparatory to laying out definite projects for 1918.

Marketing.—Marketing and cooperative organization was taken up during the year. Several cooperative associations and 11 Federal farm-loan associations were formed. Considerable work was done by the field agent in working out plans for short-term credit. The plans received the indorsement of the banking committee of the State council of defense and the State bankers' association and were of great value in increasing production and marketing as a part of the war work.

SURVEY.

The close coordination of the extension work with the activities of the State council of defense and the Food Administration resulted in the food production and conservation work in the State being conducted as one piece of work. Farm bureaus have been organized and are actively supporting the extension work in every county. The demonstration feature has been made strong in connection with food production. Crops raised in the State came far short of meeting the food requirements. City gardening was fostered by the regular extension agencies, and through special agents employed by the municipalities. The canning and drying work was fostered through special schools held for the training of community leaders, and through these leaders every section of the State was effectively reached. The boys and girls in their response to this call for increased food products showed not only their interest and loyalty but the result of thorough organization and efficient leadership. The high cost of feed, both for poultry and dairy cattle, stimulated interest in feeding and economical production. The surveys made of poultry and dairy farms resulted in securing information which will be of utmost value to extension workers. Particular credit is due the State for the thorough organization of all interests in carrying out this war program.

DELAWARE.

Division of Extension Service, Delaware College, Newark.

HARRY HAYWARD, *Director*.

Organization and administration.—The director of extension, who is also dean of the college of agriculture and director of the experiment station, continued to act as county-agent leader. A dairy agent was employed cooperatively with the Bureau of Animal Industry of the United States Department of Agriculture.

Publications.—The only publications issued during the year were a few small leaflets on local problems prepared and distributed by the county agents in their respective counties.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$12, 345. 76
Smith-Lever, State	2, 345. 76
United States Department of Agriculture, farmers' cooperative demonstration work	821. 66
Bureau of Animal Industry	1, 083. 38
Total	16, 596. 56

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' clubs, poultry, marketing, and dairying. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work and dairying.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents June 30, 1916, 3; June 30, 1917, 2, the work in one county having been temporarily discontinued.

The following are the results of some of the principal activities during the year: One thousand seven hundred and thirty acres of corn were planted with fall-selected seed and one cow-testing association was organized with 351 cows. In addition to the regular work, the agents were instrumental in having 4,000 bushels of seed corn saved for use in 1918, and in having the winter wheat acreage increased by 1,200 acres. They also assisted the farmers in securing farm labor and fertilizers in order to encourage food production to meet war needs. Ninety-two definite demonstrations, involving 5,885 acres of crops, were arranged and supervised by the agents. The agents made 1,680 visits to farmers and took part in 172 meetings during the year.

Home economics.—Prior to September the home-economic specialist gave demonstrations in response to requests made to the State college by various women's organizations. She held 7 home-makers' schools, each of 4 or 5 weeks' duration, with 3 weekly meetings, as a result of which 6 permanent study clubs were formed. Though employed only on part time, she was able to reach all the organized groups of women in the State, and aroused considerable interest in nutrition, child welfare, and better cooking. In August a State leader and two home-demonstration agents were appointed. More and better poultry was emphasized in Sussex County, and food conservation and preservation in Kent County. Food-conservation campaigns were later conducted in Sussex County by an assistant home-demonstration agent.

Boys' and girls' club work.—Twenty canning demonstrations were given during the year, with a total attendance of 847 club members, women, and men. In addition to this there were 5 field demonstrations and 25 club exhibits. Three thousand copies of follow-up instructions were used to help the club members in their work. Although only 59 members were enrolled they reported products with a total value of \$1,629.48. The number of clubs completing work, members reporting, and resulting products were as follows: Corn, 4 clubs, 16 members, reporting 16 acres producing 1,080 bushels of corn; canning, 3 clubs, 17 members reporting 1,407 jars of canned fruits, vegetables, meats, soups, and jellies, valued at \$279.48.

Dairy extension.—The work of the previous year in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture was continued, but ceased upon the resignation of the specialist on April 30, 1917. A silo survey conducted through the schools showed 30 silos in the State. Three cow-testing associations, one organized during the year, were supervised. One cooperative bull association was formed, five junior cow-testing clubs were organized, and nine pure-bred bulls were secured for farmers. The specialist made 1,154 farm visits and addressed 41 meetings with an attendance of 1,790.

Poultry.—Poultry-extension work was interrupted by the sickness and resignation of the professor of poultry husbandry.

Marketing.—A survey investigation of the marketing of farm products was conducted during three months—July, August, and September—in cooperation with the Bureau of Markets of the United States Department of Agriculture.

OTHER EXTENSION WORK.

Farm-management demonstrations.—Farm-management demonstration work resulted in 14 farmers keeping simple accounts of their business. This work was handled principally by the county agents.

SURVEY.

Delaware offers opportunities for intensive extension work not exceeded by those of any other State. With only three counties, all easily accessible from the college, an excellent opportunity is offered for personal work. Possibly this ease of access has resulted in a larger dependence upon the college staff of specialists than would otherwise have been the case. The county-agent's work for stimulating crop production gave results in increased acreage of corn and wheat. The employment of separate leaders to lead the county agent and the boys' and girls' club projects should result in strengthening those lines of work. The schools for home makers held throughout the State, resulting as they did in the formation of permanent study clubs, promise, if systematically followed up, to result in widespread home-making information.

IDAHO.

Extension Division, University of Idaho, Moscow.

O. D. CENTER, *Director* (resigned August, 1917).

L. W. FLUHARTY, *Director* (appointed October, 1917.)

Organization and administration.—There were no important changes in organization or administrative policy during the year.

Publications.—Three bulletins, 2 Farm Hints, and 5 circulars, in editions aggregating 25,000 copies, were published, and 2,403 articles for the press were prepared and distributed during the year.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal.....	\$15,699.54
Smith-Lever, State.....	5,699.54
United States Department of Agriculture, farmers' cooperative demonstration work.....	7,131.10
Bureau of Biological Survey.....	1,620.82
Bureau of Animal Industry.....	1,005.78
State appropriations	11,437.16
Total.....	42,593.94

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, extension schools, horticulture, and animal husbandry. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, boys' and girls' club work, dairying, hog-cholera control, and the control of mammal pests.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents June 30, 1916, 7; June 30, 1917, 11.

Among the outstanding results of the activities of the agents during the year were the following: Four thousand eight hundred and ninety acres of oats were sown with treated seed; 227 farmers were induced to treat their seed potatoes to control potato diseases, and 5,549 acres were planted with treated seed; 128 registered sires were transferred at suggestion of agents; 3 cow-testing associations were organized, bringing 1,105 cows under test; 18,714 animals were treated for black-leg and 110 additional silos were built at suggestion of agents. The agents made 7,061 farm visits and took part in 965 meetings. Farm bureaus were organized in each of 11 counties, with a total membership of 4,348. Exceptionally effective work was done by the farm-bureau committees in the control or eradication of grasshoppers, ground squirrels, and live-stock diseases and in cooperative buying and selling. Two hundred and thirteen boys' and girls' clubs were organized, with 2,489 members; 37 agricultural observation parties were conducted by agents to visit demonstrations, attended by 882 persons. The agents arranged for and supervised 609 demonstrations involving 27,813 acres of crops and 13,494 live stock.

In addition to the above work, the agents carried on special campaigns to stimulate increased production of crops and live stock to meet the war needs. They assisted farmers to secure 3,953 laborers, 6,620 bushels of seed wheat, 4,240 bushels of seed oats, and 3,177 bushels of seed potatoes. Due to these campaigns, the acreage of crops was increased as follows: Wheat, 14,635 acres; potatoes, 3,110 acres, increasing the production of potatoes half a million bushels; beans, 2,230 acres, increasing production 18,920 bushels. Through campaigns to increase live-stock production 16,100 additional sheep were raised. One hundred and eighty-five horses were located by the agents for the United States Army. Eight farm-loan associations were organized to assist farmers in obtaining farm credit.

Home economics.—Work was presented in every county in the State by two State-wide workers who occasionally had the help of two additional workers. The program during the year covered special projects, extension schools, requested meetings among rural women, and judging at fairs. Special meetings for farm women were held in connection with State agricultural conventions, at which preliminary plans were often made for work in communities where none had been done. Sixteen women in different parts of the State volunteered to work on a project to demonstrate the value of the budget system in conducting the business of the farm home, and reported to the State leader of home economics at regular periods. In coopera-

tion with the State Parent-Teacher's Association another project on child nutrition and welfare was carried out. Five extension schools, attended by 1,077 farm women, were held during the year, and 57 meetings with organized groups of women with an attendance of 3,577.

Women were appointed as emergency home demonstration agents to work in districts comprising several counties. The initial campaign in the conservation of food was in canning and drying. This was followed by a State-wide program which emphasized: Conservation of food through substitution, home gardens, and the production of poultry; conservation of labor by a wider use of practical labor-saving appliances in farm homes; and conservation of clothing by renovating, remodeling, and more careful selection of materials.

Boys' and girls' club work.—Boys' and girls' club work was conducted by a State club leader, an assistant leader, 4 county leaders, 30 local leaders paid by local organizations, and 295 volunteer unpaid local leaders. Four schools were held for training the local leaders. Twelve completed productive projects were reported. The total number of club groups organized was 327, with a total enrollment of 2,049 members. The total value of products reported was \$20,917.55 and the total cost \$7,228.70. During the year 208 canning demonstrations were conducted, 45 field demonstrations, 30 club festivals, and 14 club exhibits. The club leaders in the State visited 2,390 club plats during the year and a total of 42,955 copies of follow-up instructions was sent out to club members. The work of the canning clubs of the State resulted in a special contribution in food production, 12,246 jars of fruits, vegetables, meats, and jellies having been canned by the boys and girls.

The chief items of interest regarding the completed projects are given in the following table:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	10	6	5 acres.....	225 bushels....	\$607.50	\$97.98
Potato.....	51	163	27.225 acres....	5,421.6 bushels..	4,066.20	1,898.39
Home garden.....	50	139	5,979 square rods.	.....	5,299.90	1,053.64
Poultry.....	23	71	.....	1,122 chicks....	611.50	189.97
Baby beef.....	1	12	12.....	5,000 pounds....	350.00	200.00
Pork and crop.....	35	44	67.....	9,820 pounds....	1,473.00	641.35
Canning.....	32	93	.....	12,246 quarts..	3,984.05	2,300.49
Cooking.....	3	5	.....	1,733 jars jelly..	.....	.....
Bread making.....	16	6	.....	344 articles....	78.00	45.00
Garment making.....	95	136	.....	390 loaves.....	31.20	19.50
Yard.....	10	446	3,327 square rods.	827 pieces.....	164.15	109.40
Butter.....	1	15	.....	.....	4,242.05	648.98
.....	.....	.....	.....	75 churnings....	60.00	21.00
Total.....	324	1,131	.....	.....	20,917.55	7,228.70

Total enrollment, 2,049.

Extension schools.—During the year 15 extension schools were held in 12 counties, each lasting from 2 to 5 days. In every instance where a school was held in a county without a county agent a local organization was formed, with a chairman and secretary, who, with three others, constitute an extension-school committee. This committee will make arrangements for other extension schools or similar meetings, and through it the extension staff will keep in close touch with the community.

Animal husbandry.—The live-stock projects of the previous year in demonstrating the hogging-down of peas and beans, the organization of pig clubs, and the building of hog houses were continued. Through the efforts of the specialist a State live-stock association of 150 members and another association of all the 33 county and municipal fairs in the State were organized. Attention has been given to increasing the number of flocks of sheep and introducing the most practical systems of management.

An effective campaign for the control of hog cholera was conducted in five counties by a veterinarian of the Bureau of Animal Industry of the United States Department of Agriculture under a cooperative project with the extension division and the State live-stock sanitary board.

Horticulture.—Demonstrations in the growing of seed potatoes were continued with about 100 farmers. The Idaho Potato Growers' Association was organized to promote the standardization of potato varieties. Some demonstrations in orchard pruning were made, and attention was given to preventing the spread of blight, which had killed many apple trees by affecting the roots and collars. Beautification of home grounds was encouraged through lectures and plans for planting.

OTHER EXTENSION WORK.

Control of mammal pests.—Campaigns for the control of ground squirrels and jack rabbits were conducted in 17 counties, chiefly in cooperation with the county agents. Seventy-nine demonstrations in the control of ground squirrels were made in 11 counties, in which 4,400 ounces of strychnine were used, and which covered 364,500 acres. As a result of these campaigns the damage done by jack rabbits and ground squirrels was reduced 50 to 90 per cent in counties where thorough work was done. This work is carried on in cooperation with the Bureau of Biological Survey, United States Department of Agriculture, a special agent being in charge.

Hog-cholera control.—During the year a cooperative project was arranged with the Bureau of Animal Industry, United States Department of Agriculture, whereby a veterinarian was assigned to extension work in the control of hog cholera. The work was carried

on in 10 counties, and 518 hogs were treated and 18 demonstrations given. Infection was prevented from spreading to other farms in 46 outbreaks, and 92 farms were cleaned and disinfected. One hundred and one meetings were held, with an attendance of 5,871. As a result of the work there was a great reduction in the number of outbreaks from that of the two previous years.

Pure-seed control.—The director of extension work continued to administer the State pure-seed law under a separate State appropriation. Examinations were made at the State laboratory of 112 samples for germination and 1,655 samples for purity, 591 of the latter being condemned on account of an excess of noxious-weed seeds. The inspectors of the laboratory visited 76 towns and inspected 1,098,386 pounds of seed.

SURVEY.

The county-agent work showed a healthy growth, and the record of work performed indicates active cooperation on the part of farmers. Through organized work by farm-bureau associations, successful campaigns were conducted for the eradication or control of various animal diseases and crop pests. The demonstrations of value of the budget system in the farm home should result in permanent benefit. Through extension schools and meetings with organized groups of women, effective instruction was given in the war program of food conservation. Live-stock interests were promoted through the organization of a State live-stock association and through the association, county, and municipal fairs. The development of the sheep industry and the control of animal diseases were leading features of the animal-industry work. The results in the control of ground squirrels and jack rabbits illustrate the success which can be attained through organized effort.

ILLINOIS.

Division of Demonstration Work, College of Agriculture, University of Illinois, Urbana.

E. DAVENPORT, *Director*; W. F. HANDSCHIN, *Vice Director*.

Organization and administration.—No important changes were made in the organization or administration during the year. The general staff consisted of the director, vice director, who acts as a State leader of county advisers, a superintendent of extension work, and a director of home economics. To meet the war-emergency work the State was divided into seven districts and a man and a woman assigned to each district to act as leaders in organizing the emergency food production campaign. The reorganization of the

State department of agriculture resulted in a somewhat closer cooperation between that department and the extension division, as the former now includes a number of activities not included before the reorganization.

Publications.—Ten extension circulars, totaling 163 pages and 126,000 copies, were issued during the year. A few small leaflets dealing with special subjects were also published and distributed by the county agents and the chairman of the food committee of the State council of defense. A few posters were issued and numerous short articles of 300 to 500 words on timely subjects were prepared and given to the press of the State.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal.....	\$58, 184. 03
Smith-Lever, State.....	48, 184. 03
United States Department of Agriculture, farmers' cooperative demonstration work.....	12, 833. 23
College.....	2, 374. 00
County.....	26, 033. 36
Other sources within the State.....	24, 089. 47
Total	171, 698. 12

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, farmers' demonstration work, and extension specialists. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, boys' and girls' club work, and farm-management demonstrations.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties covered by agents June 30, 1916, 20; June 30, 1917, 22. The work was supervised by a county-agent leader and one assistant.

Among the outstanding results of the activities of the Illinois county agents during 1917 were the following: More than 4,800 farmers were induced to select their seed corn in the fall and test their seed corn for germination for more than 250,000 acres, and 2,000 farmers treated for smut the seed oats used on 430,000 acres. In most counties which have had county agents for two or three years the practice of treating oats for smut is reported to have become so common that attention was merely called to the matter in circular letters and through the local press. The agents made a special effort to encourage the growing of more legumes, both for

forage and for soil improvement. Forty-three thousand acres of clover were plowed under for green manuring, 1,441 farmers sowed 26,430 acres of alfalfa, and 11,920 acres of sweet clover and 23,763 acres of soy beans were grown. Eight cow-testing associations were organized, and 6,511 cows put under test in such associations organized by agents, resulting in 578 cows being discarded as unprofitable. The agents induced 1,462 farmers to keep farm accounts. Farmers' exchanges and other purchasing and marketing associations, formed with the assistance of or at the suggestion of the agents, handled nearly a third of a million dollars' worth of products during the year, with a saving of \$27,250. One hundred and thirty farms were rented through these associations and the offices of county agents. The agents arranged for and supervised 502 demonstrations involving more than 100,000 acres of crops and 85 live stock.

In addition to the above work the agents made special efforts to stimulate increased production of crops and live stock to meet the war needs. More than 9,000 bushels of seed wheat were located for farmers, and the wheat acreage of the State was increased by more than 9,000 acres. In every county the county agent was appointed chairman of the county food, fuel, and conservation committee of the State council of defense. More than 5,000 additional acres of corn were grown, thereby increasing the production in the State about 250,000 bushels. The county agents in those localities where there was likely to be a shortage of farm labor for harvesting the corn crop anticipated the labor shortage, and by advertising in weekly papers in a few neighboring States secured ample laborers for their counties. Three hundred and sixty-eight farmers were assisted in securing 7,251 tons of fertilizers.

The agents made 7,589 visits to farmers, received 27,497 calls at their offices, and took part in 1,120 meetings attended by more than 80,000 persons. Fifty-seven agricultural observation parties were conducted, attended by 4,953 persons. The membership in associations organized to promote agricultural-improvement work in county-agent counties was 10,894 on December 1, 1917—an increase in membership of 3,300 during the year.

Home economics.—The scope of home economics extension work was considerably enlarged during the year. The chief lines of work included were movable schools, which were held in more than half the counties in the State; a school for housekeepers, attended by more than 500 women; a home-economics school for girls, held annually at the State fair, the registration of students representing practically every county in the State; and a home economics demonstration car, which served 20 communities, most of them for a period of one week.

During the year 30 types of organizations were served in various ways and the number of women reached exceeded 35,378. One of the most gratifying features of rural development resulting from these activities was the definite interest shown in farm home equipment, home furnishing, and sanitation. From a survey made through the public schools data were secured showing the household equipment of 29,000 farm homes. A varied program was outlined for the war emergency, comprising: A class in Red Cross instruction, including first aid, field hospital, surgical supplies, and a special course in dietetics, attended by 140 women; a two weeks' course in canning and drying, conducted especially for junior and senior students in the university who had volunteered their services to their respective districts for the summer work, and who thus reached over 5,943 housekeepers; 5-day canning and drying schools for urban women; a vacation school held in one county under the supervision of the county agent at which direct instruction was given by the class leader; and a two weeks' training school held early in the summer for emergency home-demonstration agents, at which a progress was outlined for the conservation of foods.

Seven district home-demonstration agents were appointed September 1, 1917, to do intensive work in certain counties in order to pave the way for permanent organization. At the end of December there were two country home-demonstration agents.

Urban home-demonstration agents were appointed for Chicago, Peoria, Springfield, and East St. Louis. In Chicago, work on the selection and simple preparation of nutritious foods was done in some of the settlement areas in cooperation with the council of defense and the public schools. In Peoria, through the cooperation of all the welfare organizations, the home-demonstration agent gave instruction on food, clothing, and sanitation to large groups of mothers. The domestic-science teachers were organized as aids in food conservation and reached many women through the schools.

Farm-management demonstrations.—Seven counties took up the work during the year, making a total of 17 conducting farm-management demonstrations. Considerable work was done teaching farmers how to study their business through simple farm accounts and what are the principal items to be considered in figuring the cost of production of various farm products. The county agents and farm-management demonstrators assisted 1,462 farmers to keep accounts. Farm-analysis records were taken on 205 farms, 172 of these were summarized and personally returned to the farmers. As a result of farm-management demonstration work 505 farmers changed their management in order to increase their labor incomes.

Departmental advisers.—Members of the college departments of agronomy, animal husbandry, and horticulture assisted the county

advisers and farmers' organizations along technical lines. The equivalent of time of $1\frac{1}{2}$ men in each of these departments was given to this work. Special assistance was given in the organization of live-stock breeders' associations and in the production of pork on forage crops. Educational poultry campaigns were conducted. In dairy husbandry the principal work was the organization of cow-testing associations, which increased from 4 to 17 during the year, and the assisting of manufacturers in the improvement of their products. The horticultural activities consisted of pruning and spraying demonstrations, the standardizing of orchard products, particularly apples, advising as to the improvement of home grounds, and the encouragement of farm-home gardens. In southern Illinois the use of limestone on acid soils was promoted. Assistance was given new county advisers in the identification of soil types. Advisory work as to farm crops followed the usual lines.

OTHER EXTENSION WORK.

Boys' and girls' club work.—The State leader was assisted in conducting the work by 20 assistant county and emergency club leaders. The work developed rapidly during the year, the total enrollment increasing to 15,290 in 685 club groups under 7 projects. The general plan used in organizing the work was to develop local committees or organizations to direct the work within a county or community. In a county the advisory committee usually consisted of the county superintendent of schools, the county agent, and several other interested persons. The club leaders in conducting the work sent out 40,000 copies of follow-up instructions.

The following table shows some of the more important facts regarding the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	70	351	236.25 acres....	6,048.4 bushels.	\$4,659.69	\$2,244.06
Potato.....	40	143	17 acres.....	2,013 bushels..	3,103.42	588.15
Mother-daughter canning.....	403	11,885	.....	628,585 quarts..	184,195.99	26,526.09
Garment making.....	6	45	.....	155 pieces.....	114.57	98.08
Poultry.....	117	449	.....	5,653 chicks; 2,500 dozen eggs.	5,300.00	1,238.48
Pork and crop.....	44	173	216.....	29,986.2 pounds	8,652.98	3,638.84
Total.....	680	13,046	.....	.....	203,029.55	34,333.70

Total enrollment, 15,290.

SURVEY.

The stimulation of crop production, particularly corn, and the adoption of measures to control plant disease, were the outstanding features of the county-agent work. This work was done without neglecting the maintenance of soil fertility, and the growth of legumes, particularly clover, alfalfa, and soy beans, contributed materially to both increasing meat production and to soil improvement.

The survey conducted through the public schools to determine the household equipment in the farmhouses of the State should result in the formulation of plans for effective demonstrations and instruction as to household conveniences. Through the use of women's organizations the program of food conversation was effectually presented throughout the State. The increase of cow-testing associations from 4 to 17 indicates determination on the part of dairy farmers to weed out the boarder cows.

INDIANA.

Division of Agricultural Extension, Purdue University, *La Fayette*.

G. I. CHRISTIE, *Superintendent of Extension*.

Organization and administration.—The general organization and administrative policy continued the same as in the previous year. The assistant county-agent leader was made county-agent leader.

Upon the declaration of war the superintendent of extension was appointed State food director as chairman of the committee on food production and conservation of the State council of defense, and effectively organized the agricultural forces of the State to meet the war situation. The manner in which the extension service with its large corps of trained workers rendered assistance to the people in this food campaign indicated as never before the value of the maintenance of a State and national extension service. Soon after the declaration of war mass meetings were held in every county to consider plans for food production and conservation and to perfect county organizations and programs. An important feature of the work was the organization of county labor committees. Campaigns for dairy production, silo construction, wheat growing, and canning and drying were conducted throughout the State.

Publications.—During the year there were published, in editions of from 2,000 to 20,000, the following: Twelve extension bulletins, aggregating 136 pages; 8 leaflets, aggregating 38 pages; the Fifth Annual Report, of 68 pages; and 13 folders, including 9 numbers of "The Hog News."

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal.....	\$44,706.87
Smith-Lever, State.....	34,706.87
United States Department of Agriculture, farmers' cooperative demonstration work.....	16,990.18
Bureau of Animal Industry.....	2,859.64
State.....	44,558.30
County.....	55,620.08
Other sources within the State.....	23,272.40
Total.....	222,714.34

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, extension schools, animal husbandry, botany and plant diseases, horticulture, poultry work, rural engineering, soils and crops, and animal diseases. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, boys' and girls' club work, farm-management demonstrations, animal husbandry, and dairying.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties covered by agents June 30, 1916, 32; June 30, 1917, 40. The work is supervised by the superintendent of agricultural extension serving as county-agent leader, with three assistant county-agent leaders.

Among the outstanding results of the activities of the Indiana county agents during 1917 were the following: Eight thousand one hundred and eighty-eight farmers tested their seed corn for germination for 187,090 acres, and more than 200,000 acres of corn were planted with fall-selected seed; 7,177 farmers were induced to adopt other improved methods of corn growing; 4,198 farmers raised wheat, following the suggestion of agents; 8,072 farmers treated their seed oats for smut for an area of 148,634 acres; 2,441 farmers treated their seed potatoes to control scab and other potato diseases, and 7,886 acres were planted with treated seed; and 1,249 farmers followed the suggestion of agents in growing 11,846 acres of soy beans. Considerable attention was given to live-stock improvement. Seven cow-testing associations were organized; 153 registered bulls and 586 registered cows were secured; 1,270 farms were persuaded to adopt balanced rations; 34,719 hogs were vaccinated at the suggestion of agents; 11 hog-cholera control clubs were organized; and the silo campaign resulted in the erection of 1,386 new silos.

In order to enrich and improve the soil and bring about increased crop production, 882 farmers were induced to reinforce manure with acid phosphate or ground-rock phosphate; 7,085 farmers used 15,699 tons of chemical fertilizers; 43 local sources of lime were developed; 53,238 tons of lime or limestone were used at suggestion of agents, and 26,841 acres of hay land were top-dressed; 71 drainage systems were planned and adopted, draining 2,443 acres. The agents induced 1,151 farmers to keep farm accounts and took farm-analysis records on 586 farms; as a result of this work 1,216 farmers modified their farm-management plans. The 41 farmers' exchanges and 17 other purchasing and marketing associations established with the assistance of agents did nearly \$800,000 worth of business, saving \$31,818 to the farmers.

The county agents arranged for and supervised 2,767 demonstrations, involving 72,978 acres of crops and 3,983 live stock. The principal crop demonstrations were carried on for the control of oat smut on 45,012 acres and the control of Hessian fly on 16,000 acres, while the principal live-stock demonstrations were held to show the control of blackleg. In connection with the demonstrations conducted, the agents held 490 meetings, attended by 15,737 persons. The agents made 9,870 farm visits, received 39,859 calls at their offices, and took part in 4,829 meetings attended by 279,947 persons. There are 12,568 members in associations promoting county-agent work, while 128 farmers' clubs and 65 other associations were organized for adults. The extension schools conducted had an enrollment of 39,602 persons, and 1,059 meetings or demonstrations were held, at which assistance was rendered by specialists from the college or United States Department of Agriculture.

In addition to the regular work, the agents did a large amount of effective work to increase crop and live-stock production to meet the war needs. One thousand seven hundred and seventy-six laborers were furnished farmers, and 33,595 bushels of seed corn, 9,518 bushels of seed potatoes, 106,479 bushels of winter wheat, and 6,903 tons of fertilizers were secured or located for farmers through the county agents or their offices. As a result of a special corn-production campaign, the corn acreage was increased by 171,290 acres, thereby increasing the production more than 1,500,000 bushels. In order to provide against a heavy shortage of seed corn for 1918 the agents were instrumental in having 188,641 bushels of seed corn saved. The potato acreage was increased by 11,457 acres, thereby increasing the production nearly 500,000 bushels, and 272,550 additional acres of winter wheat were sown. It is estimated that the campaigns for increased live-stock production carried on by the regular agents during 1917 resulted in 11,923 additional sows being bred and more than

100,000 additional chickens being raised. The agents assisted in organizing 19 farm-loan associations. Seven thousand four hundred and seventy-one farmers were given information regarding storing of fruits and vegetables, while 331 canning demonstrations were arranged for, resulting in the canning of 257,350-additional quarts of fruit and vegetables.

Home economics.—A large and growing demand for assistance in home economics was made by the women in the State. The extension division employed four women to give their entire time to this work, while part time of 15 other women was used in demonstrating and making home surveys. To assist the State leader in county organization work three assistants were appointed. The State leader planned to work with the farm-betterment association where possible, and in counties where such organizations did not exist, to form an independent organization of women from all local groups. By December 31, 1917, home-demonstration agents were at work in four counties, and nine counties were organized and ready for agents as soon as they could be secured. Twenty-seven home-study classes were organized, for which special outline programs were prepared by the department. Sixty-eight home-economics classes were visited by the workers, who gave lectures and demonstrations. Farm home-study tours were conducted in three counties in cooperation with the county agents and women's organizations. Eleven short courses were given in the winter, with an attendance of 8,809. Demonstrations of canning and drying and other methods of conserving food were given in 300 communities, with an attendance of 30,000. Three hundred women who were willing to give some time to forwarding the food-conservation movement attended an emergency food course given at the college in June.

Prior to January 1, 1918, two urban home-demonstration agents were appointed in Indianapolis. Plans for work in other cities, however, were well under way, as there was a growing demand for assistance in home economics from city women throughout the State. The city work included the study of food values; the demonstration of war cookery to organized groups of city women whose cooperation in volunteer service was active; the preparation of exhibits for various purposes; the preparation of articles on home economics for the press; the canning, drying, and storage of perishables; and the establishment of municipal kitchens.

Boys' and girls' club work.—The boys' and girls' club work was conducted by 23 cooperative club leaders employed permanently by the State college and the United States Department of Agriculture, together with 47 leaders paid cooperatively for part time, and 16 volunteer leaders. These local leaders visited every member of their clubs at least once every 10 days, to give instructions, assistance with

records, and encouragement to overcome difficulties. Thirty-one county agents also gave supervision to home-project work. The membership under these teachers and agents comprised only 18 per cent of the total enrollment, yet they made 86 per cent of the total net profits for the State. Fourteen subject-matter projects were carried on during the year. In the completed club projects 431 club groups were organized, with a total enrollment of 15,957 members. These members reported products to the value of \$310,872.70, with a total cost of production of \$124,312.70. Seventy-five per cent of the club groups and 63 per cent of the club members had done club work during the preceding year. During the year the club leaders conducted 57 canning demonstrations, with a total attendance of 4,348 club members, women, and men. In addition there were conducted 56 field demonstrations, 67 club fairs and festivals, and 93 club exhibits. Three hundred and eighteen club plats were visited, and 47,000 pieces of instructional literature were sent out to the club members during the year.

The following table gives some of the important items regarding the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product		
				Amount.	Estimated value.	Estimated cost.
Corn.....	103	850	1,897.8 acres...	114,208 bushels	\$112,122.00	\$33,369.00
Potato.....	42	326	146.4 acres.....	11,069 bushels.	15,680.16	4,049.09
Home garden.....	67	11,811	155,633 square rods.	.....	87,348.00	20,748.00
Poultry.....	42	385	806 fowls.....	9,302 chicks, 95 dozen eggs.	5,531.00	2,469.00
Baby beef.....	2	14	16 beeves.....	12,640 pounds.	1,390.00	1,016.00
Pig.....	41	655	1,089 pigs.....	.....	40,265.62	23,967.56
Calf raising.....	10	152	250 cows.....	.....	26,153.00	24,128.00
Home canning.....	55	1,129	.....	82,784 quarts..	18,156.30	11,900.30
Bread.....	23	294	.....	12,927 loaves..	1,292.70	841.57
Garment making.....	41	389	.....	2,194 pieces...	1,223.92	726.27
Tomato.....	5	42	28.2 acres.....	.....	1,710.00	1,089.09
Total.....	431	15,957	.....	.....	310,872.70	124,312.70

Total enrollment, all projects, 22,733.

One boy who was a member of a pig club for the second year fed 17 grade hogs and made a profit of \$99.30. Because he and other pig-club boys used self-feeders, 34 self-feeders were brought into use in a period of six months in a locality where none had been used before. At the close of the year the club members, who were champions in their respective lines of work, were given a one week's short course at the Purdue University, with all expenses paid. Following this, 16 champions in corn club, pig club, poultry club, dairy club, sewing and garment-making clubs, were given a trip to the National Capital,

where one week was spent in visiting points of special interest and in meeting persons of national prominence in agriculture and other lines of work.

Extension schools.—Eleven farmers' short courses were held with a total attendance of 8,809. All these lasted for four days instead of two to three days, as in previous years, thus permitting greater thoroughness and the addition of work in textiles and clothing for women, and farm management for men. The instruction staff consisted of seven men and two women, and a carload of live stock and equipment was taken from the university to each school. As a result of the live-stock instruction at one school, 25 farmers built silos, and in another community 20 sprayers were bought as the result of instruction on pruning and spraying orchards.

Animal husbandry.—Methods of feeding and management of live stock were demonstrated in several counties. The object of this work was to give people interested in live stock an opportunity to compare the value of balanced rations with the rations ordinarily used under local conditions, and to study different methods of feeding and management. Fifteen cooperative steer-feeding demonstrations using 1,172 steers were completed in 14 counties. In one demonstration in which three lots of steers received the same feeds, except that ear corn, broken ear corn, and shelled corn were used, the lot receiving shelled corn gave decidedly better results. Fourteen demonstrations of the use of self-feeders with 1,438 hogs showed the value of protein supplements to corn being hogged off. Four lamb-feeding demonstrations, using 841 lambs, showed the value of corn silage as roughage with cottonseed meal. In connection with all the demonstrations, meetings were held so that farmers might see the animals and study the results secured. Farmers' tours to many good live-stock farms were made, and many live-stock judging contests have been conducted.

Botany and plant diseases.—The botanical work consisted of demonstrations of control of plant diseases and weeds in cooperation with county agents. An oat-smut campaign was conducted in 12 counties, 32 demonstrations of seed treatment being held, with an attendance of 1,504. As a result of this campaign and that of the previous year, it is estimated that 2,000,000 bushels of oats were saved this year. Fourteen demonstrations in the control of wild garlic and red sorrel were conducted. Wild garlic has been completely eradicated as a result of cultural methods combined with spraying with crude oil. Instruction concerning weeds was given to many of the schools.

Dairying.—Supervision of cow-testing associations was continued, the number increasing from 8 to 11, and including 220 herds of 3,220 cows. Assistance was given in the purchase of 39 pure-bred bulls. Two dairy associations and 6 community breeders' associations were organized. A study of the cost of milk production was conducted in

Porter County. Ten automobile tours to leading dairy farms were conducted, and a special dairy train was operated in southern Indiana attended by 1,475 people. This work is in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture.

Horticulture.—Orchard pruning and spraying demonstrations were conducted in a large number of communities. Contracts for the operation of 14 demonstration orchards in 10 counties which provide a year round demonstration for a 3-year period were made with the owners. In cooperation with the county agent, an apple-packing show was conducted in Orange County. Assistance was given many communities in the planning and planting of home, school, and church grounds, which now serve as demonstrations of good landscaping to other homes and institutions. During the summer a war-garden campaign was organized in 45 cities. To facilitate distribution, communities were organized for marketing locally-grown garden products and 22 local cooperative market advisers were appointed in cooperation with the State food committee.

Poultry.—Fourteen poultry-demonstration farms have been located in different parts of the State to demonstrate the best methods and equipment for profitable poultry production under farm conditions. Twelve "record farms" have also been secured, where detailed records are kept of all operations. The records from these demonstrations show that the labor income from an average flock of 141 hens increased from \$196.63 or 37 cents per hour in 1915 to \$258.00 or 48 cents an hour in 1916, this increase being due to better methods of housing, brooding, and feeding. As a result of observation of these demonstrations, many farms are adopting new equipment and methods and are thereby increasing production. A campaign was waged during the summer for the elimination of male birds, in order to secure infertile eggs and reduce feed costs. During "Rooster week," June 18-23, more than 50,000 male birds were marketed.

Rural engineering.—Extension work in rural engineering was inaugurated and proved popular. Six demonstrations in the installing of water systems, septic tanks, lighting and heating systems were given, and when completed community meetings will be held for observation and discussion. Over 40 farm visits were made to advise concerning drainage of wet lands. Many plans for houses, farm buildings, and septic tanks were furnished. In cooperation with a county agent, a four-day engineering short course for farm-tractor operators was held with an exhibit of farm machinery. The attendance was 2,100.

Soils and crops.—Field demonstrations in the production of new and little known crops have been continued. Thirteen demonstrations of the growth of soy beans with corn for silage made during

the last three years have shown an increase of 2,693 pounds per acre of green weight over corn alone. Demonstrations of the value of liming acid soils were arranged with 42 farmers in southern Indiana, and soil acidity surveys were made in three counties. Three hundred and fifty farmers finished the 5-acre corn contest. Seven demonstrations of the ear-to-row method of corn improvement were conducted.

Animal diseases.—Assistance was given in a large number of communities in organizing for the control of hog cholera. It has been found that when the farmers of a community interest themselves in the control work and watch closely all outbreaks of disease, so that control measures are promptly taken, losses were materially reduced. In 1915 in one small community 1,884 hogs were raised and 579 died from disease; in 1916, when an organized effort was made by this community to prevent the spread of cholera, 2,291 hogs were raised, with a loss of only 17. Five district organizations of veterinarians have been formed. These give the veterinarians an opportunity to come together for the discussion of local problems and to agree upon the best practices for the control of hog cholera and other animal diseases.

OTHER EXTENSION WORK.

Farm-management demonstrations.—Farm-management demonstration work in Indiana made much progress the past year. Fifteen new counties took up the work, making a total of 28 in the State. One thousand one hundred and fifty-one farmers were assisted by the county agents and farm-management demonstrators to keep simple farm accounts. In addition 586 farm-analysis records were taken and summarized, and 501 of these were returned and discussed personally with the men who gave them. As a result of farm-management demonstrations, 1,216 farmers changed the management of their business in order to increase the returns.

SURVEY.

The recognition of the agricultural-extension service by the State as the chief agency to organize agriculture to meet war conditions evidenced a confidence in the efficiency of the extension force which was merited by its subsequent achievements in increasing agricultural production, distributing farm labor, and securing food conservation. The value of county and local organizations as necessary agencies for formulating and directing war programs for agriculture was demonstrated, and many new organizations were formed. The value of paid local leadership for boys' and girls' club work is increasingly apparent as shown by the greater achievement of those working under such supervision. The evidence of definite results from extension schools furnishes an index of the value of the instruction given,

and indicates the importance of follow-up methods. The use of the farm-tour for observing demonstrations in live-stock feeding, dairying, and home economics has been developed as a valuable means for extension instruction.

The extension force in Indiana has shown its ability to cope with the new farm problems incidental to the war, and with strengthened local organization can effectively meet increased duties.

IOWA.

Division of Extension, Iowa State College, Ames.

R. K. BLISS, *Director*.

Organization and administration.—There were no important changes in the general organization or administrative policy during the year. The legislature enacted a law permitting the county boards to appropriate not exceeding \$2,500 for county-agent work after \$500 has been paid into the farm bureau by not less than 200 farmers. The year showed a marked development of organized effort; the number of organized counties employing county agents increased 81 per cent; the enrollment in boys' and girls' clubs increased 75 per cent; and the number of cow-testing associations increased 35 per cent.

The extension department assisted the president of the State agricultural college, who was appointed chairman of the State war emergency food committee in carrying out its program of food production and conservation. The extension department in April, 1917, worked out and published a plan for organizing volunteer farm-labor bureaus. Of the 391 farm-labor bureaus organized in every county in the State, 189 reported the placing of 7,896 laborers. The extension department conducted a campaign for enlisting volunteer food producers, each of whom was given a membership card and button. Altogether 20,478 persons were enlisted, 14,504 junior volunteers, 12 to 19 years of age, and 5,974 senior volunteers over 19 years of age. The campaigns for war gardens and for the conservation of fruits and vegetables by canning and drying are noted below. In cooperation with the county superintendents of schools, a seed-corn selection campaign was made through the rural schools, in which 93 of the 99 counties cooperated.

Publications.—In order to carry out the Government's war food program the extension department issued a greatly increased amount of printed material, aggregating 1,208,375 copies of bulletins, leaflets, and circulars, containing 12,438,800 printed pages; 86,500 posters were distributed, and 1,000,000 sheets of duplicated matter were sent out. The publications consisted of 27 short-course class notes, 8 home-economics bulletins, 12 home-economics circulars, 13 extension bulle-

tins, 6 extension circulars, 6 emergency leaflets, 4 junior extension circulars, and 4 posters.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$44,432.16
Smith-Lever, State	34,432.16
United States Department of Agriculture, farmers' co-operative demonstration work.....	18,557.35
Bureau of Animal Industry.....	3,108.04
Bureau of Biological Survey.....	155.00
State appropriations	72,742.18
Other sources within the State.....	1,000.20
Total	174,427.09

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, farm-management demonstrations, extension schools, dairying, animal diseases, crops and soils, agricultural engineering, poultry, and pomology. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, home economics, boys' and girls' club work, farm-management demonstrations, dairying, and creamery extension.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties covered by agents June 30, 1916, 16; June 30, 1917, 26. The work was supervised by a county-agent leader and one assistant.

Campaigns for the use of better seed corn conducted by the agents resulted in 15,230 farmers selecting seed corn in the fall and more than 500,000 acres being planted with fall-selected seed; in 8,538 farmers testing their seed corn for germination for more than 250,000 acres; and in 5,042 farmers raising 71,430 acres of corn silage, either at the suggestion of agents or according to methods recommended. Eighty-three thousand one hundred and twenty acres of oats were sown with seed treated for smut; 829 farmers sowed 6,627 acres of alfalfa at suggestion of agents, and 10,481 acres of barley were sown according to methods recommended. Considerable attention was given to live-stock improvement. Three hundred and fifty-six registered bulls and 770 registered boars were secured, 846 registered sires were transferred to other herds; 11 cow-testing associations were organized and 4,259 cows were tested in these associations, resulting in 363 cows being discarded as unprofitable. To assist in

hog-cholera control, 66 hog-cholera control clubs were organized and 62,373 hogs were vaccinated by veterinarians or farmers at the suggestion of the agents. The silo campaign resulted in 812 new silos being built. Ninety-one drainage systems covering 19,085 acres were planned and installed. Nine hundred and ninety-nine farmers were persuaded by agents to keep farm accounts. The 41 farmers' exchanges and 15 other purchasing and marketing associations, organized with the assistance of agents, did more than \$500,000 worth of business, with a reported saving to the farmers of \$109,175.

The agents arranged for and supervised 2,171 demonstrations, involving 76,157 acres of crops and 15,375 head of live stock. In connection with these demonstrations, 1,314 meetings were held, attended by 46,773 persons. Visits were made to 16,687 farms, and 33,148 calls were made at the county agents' offices for information. The agents took part in a total of 4,184 meetings, attended by 213,148 persons. Practically every county has a well-organized farm bureau, and the total membership of these associations in county-agent counties was 10,520 persons. Members are usually signed up for a three-year period.

In addition to the above work intensive campaigns, carried on to stimulate increased production of crops and live stock, resulted in more than 100,000 bushels of seed wheat, 92,454 bushels of seed oats, 6,054 bushels of seed barley, and 7,998 bushels of seed potatoes being located or secured by the county agents. As a result of these campaigns the wheat acreage was increased more than 30,000 acres; that of oats, 22,200 acres, thus increasing the production nearly 500,000 bushels; that of potatoes, 6,694 additional acres, thus increasing the production more than 400,000 bushels; and that of corn, 56,535 acres, thus increasing the production practically 2,000,000 bushels. In the seed-saving campaign it is reported that 142,000 bushels of seed corn were located and saved for the 1918 crop. The agents assisted in placing or locating 6,749 laborers on farms. Ten thousand eight hundred and forty-five additional sows were bred and 24,400 additional sheep were placed on farms. Eight hundred and thirteen canning demonstrations were held for adult women, resulting in the canning of more than 900,000 quarts of vegetables and fruits.

Home economics.—The principal activity during the first nine months of the year was the holding of extension schools in different parts of the State. During the year 169 such schools were held, with an attendance of 18,230. Out of these short-course classes, home-economics clubs have been formed, there being 1,485 such clubs, with a membership of 53,429. One home-demonstration agent was at work in Black Hawk County giving assistance to farm women in their household problems and in poultry and garden work. On December

31, 1917, there were home-demonstration agents in 14 counties and 3 cities.

A food-conservation campaign was begun early in the summer; 25 emergency agents gave 1,628 demonstrations in canning and drying fruits and vegetables, and reached 95,475 people in 98 counties, 50,352 of whom became conservation-club members. As a result of this campaign it is estimated that between 10,000,000 and 20,000,000 additional quarts of fruits and vegetables were canned in Iowa this year. Before emergency funds were available, a course of lessons, lasting from four to six weeks, was presented in 10 industrial plants in three cities, to show the women employees the relation between health and efficiency. The subjects included the selection and preparation of food, selection of clothing, care of health, care of children, and personal and household accounts; 1,195 employees were reached.

Prior to December 31, 1917, urban home-demonstration work was organized with agents in charge in Des Moines, Cedar Rapids, and Sioux City. Each city was divided into districts, with committees to work in each ward, precinct, and block. In Des Moines the tabulation of the food-conservation work during the 15-week period showed that 4,215 women were reached; that they saved 252,900 pounds of wheat, 10,537 pounds of sugar, 3,181 pounds of fat, and 252,900 pounds of meat; that 12,000 food pledges were signed; 15,000 kitchen cards were distributed; and, through the cooperation of the parent teachers' associations, food conditions were improved for 1,000 children.

Boys' and girls' club work.—The work of the boys' and girls' clubs was conducted by one State leader on full time, and 37 assistant and county club leaders were employed on part time and paid cooperatively by the State agricultural college and the United States Department of Agriculture. The club leaders were assisted in their work by 596 volunteer unpaid leaders.

The work was conducted under eight subject-matter projects. In the seven completed projects 1,061 club groups were organized, with a total enrollment of 25,366 club members who reported products to the value of \$707,487.86 at a production cost of \$212,384.22. Fifty per cent of the club groups and 50 per cent of the club members enrolled were engaged in club work during the preceding year. During the year the club leaders conducted 234 canning demonstrations, attended by 10,825 club members, women and men, 72 field demonstrations, 58 club fairs and festivals, and 165 local, county, district, and State club exhibits. The leaders visited during the year 465 club plats, and 250,000 copies of club literature were sent to members to assist them in their work.

The following table gives some of the more important facts regarding the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	263	804	2,299 acres.....	146,722.2 bushels.	\$227,365.40	\$42,347.58
Home garden.....	162	11,817	324.9 acres.....		173,355.39	28,951.65
Baby beef.....	175	356	267.....	238,289 pounds	30,977.57	15,292.28
Pig.....	196	416	453.....	93,512 pounds.	16,364.60	6,865.96
Home canning.....	190			651,509 quarts fruits and vegetables; 649 meats and soup; 141,701 jars jelly, jams, and butters.	258,169.70	118,349.25
Garment making.....	63			900 pieces.....	1,227.20	563.60
Handicraft.....	12				28.00	14.00
Total.....	1,061	13,393			707,487.86	212,334.32

Total enrollment, 25,366.

As a war-emergency program the boys and girls carried out a creditable work of achievement in food conservation. A special effort was made to interest boys and girls in small towns and cities to join the garden club. The 190 canning-club groups organized with a total enrollment of 6,695 club members, put up for home use in glass and in tin 325,143 quarts of fruits, 325,939 quarts of vegetables, 649 quarts of meats and soups, 84,937 jars of jelly, and 56,680 jars of jams and butters; for sale in glass and tin, 230 quarts of fruits, 197 quarts of vegetables, and 84 jars of jelly. The total value of these canned goods was reported as \$224,195.45, and the cost of production as \$118,349.25.

The program of work of the baby-beef clubs was conducted and finished in a very remarkable way. The work was conducted under 175 club groups, which enrolled 864 boys and girls, who produced animals valued at \$30,977.57, at a cost of \$15,292.28. These animals were grown at a cost of 6 cents per pound, while the average selling value per pound was 13 cents. The baby-beef work as carried out provided training of a very definite educational and economic value. The project required investment of capital, definite knowledge, the exercise of judgment, and business management. The clubs had the liberal support and cooperation of the beef-producers' association of the State and the district, county, and State fairs. Club champions exhibited and won prizes in the interstate fair at Sioux City and the International Livestock Exposition at Chicago. The 267 calves were fed an average of 294 days. The average initial weight

was 401 pounds; the calves each made an average daily gain of 1.67 pounds during the feeding period. The average net profit per calf was \$26.69. The animals fed included Shorthorns, Angus, Herefords, Polled Durham, Red Polled, and one grade Guernsey. The total value of prizes won by the club members at State, interstate, and county fairs, at the International Livestock Exposition at Chicago, including other prizes and short courses awarded, was \$3,490.

Farm-management demonstrations.—Work was conducted in 16 new counties, making a total of 24 doing farm-management work. A great deal of attention was given to teaching farmers the principal items which should be included in determining the cost of producing farm products. Through county agents and farm-management demonstrators 999 farmers started keeping simple accounts. Farm-analysis records were taken on 405 farms. These were summarized and returned to the farmers, and 330 of them were discussed personally with the farmers by county agents. The work has increased to such an extent that most of it is being done with interested groups rather than with individuals.

Extension schools.—Thirty-five schools were held during the year, at which 2,591 lectures, 1,655 demonstrations, and 276 judging exhibits were given, and 70,497 people were reached. Mostly the longer (5-day) schools were held in counties having county agents, and at such schools a baggage car of apparatus and a car of live stock were used. The year witnessed a considerable development in the three-day courses. Animal husbandry, farm crops, and home economics were the subjects most generally taught in the schools.

Dairying.—Attention is being given chiefly to definite organization work, and only about one-third as many lectures are given as three years ago. The number of cow-testing associations increased from 23 to 30. A man was employed for four months to visit and instruct the official testers. Four thousand dollars were saved members of the associations through the cooperative buying of feed from local dealers. Twenty-two farm tours of cow-testing associations were conducted. Three milk-producers' associations were organized, as a result of which the price received by their farmers is considerably better than that in neighboring communities. The dairy specialists gave 356 lectures, 195 demonstrations, and 59 judging demonstrations attended by 46,569 people. One of the principal objects of work in dairy manufactures is to get creameries to buy cream on the basis of quality. Substantial progress was made in securing four large creameries to adopt the policy of buying cream according to grade. This work is conducted in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture.

Animal diseases.—Substantial progress was made in animal-disease control during the year. Losses from hog cholera were light, and

outbreaks seldom extended far from the original source, due in large measure to the early use of serum and sanitary measures. Project agreements were in force with all county agents for more effective educational and demonstrational work for the control of disease. The college research laboratory assisted materially in diagnosis work and thus facilitated prompt control measures.

Crops and soils.—The principal extension work in farm crops was at extension schools and farmers' institutes. Demonstrations were conducted in methods of selecting seed corn and in the fanning, grading, and drilling of oats. With the county agents an alfalfa campaign was conducted, with 15 and 40 meetings, respectively, held in two counties. A seed-corn campaign was conducted, largely through the schools, which practically covered the State; 18,898 farm families participated in this campaign.

Agricultural engineering.—The usual service of furnishing blueprint plans for farm buildings and planning drainage systems was continued. A new feature introduced during the year which gives promise of large usefulness is the "Engineering service week." Under this plan the county agent arranges for a service week to be held in a community where several engineering problems have arisen. During the week the farmers assemble for a discussion of engineering problems and then go in small groups to some farm where their problems are actually solved. The demonstration may consist of installing a septic tank, erection of a farm building or silo, laying out a tile-drain system, or some similar work. The engineer, by being in the community for a week, is able to arrange demonstrations which can be of use for teaching purposes throughout the year.

Poultry.—The demand for help in poultry work necessitated the full time of an additional worker. Farm demonstrations were the most important feature of this work. Work at short courses and farmers' institutes and assistance to marketing associations were continued.

Pomology.—One hundred and fifty-four pruning and spraying demonstrations and 38 summer orchard-spraying demonstrations were given, and it was impossible to meet the demand for such work. Records showed that sprayed trees yielded nearly 4 bushels of apples more per tree, at a cost of about 30 cents.

OTHER EXTENSION WORK.

Animal husbandry.—Extension work in animal husbandry consisted of instruction at short courses, demonstrations in the feeding of beef cattle, dairy cattle, and hogs, street shows, town fairs, and county campaigns in cooperation with county agents. The campaigns consisted of (1) hog or pork production, including sanitation,

management, and feeding; (2) beef and butter campaigns; (3) horse and hog weeks, which were follow-up shows and demonstrations held in the same counties where work was conducted in the spring. The State beef-breeders' association cooperated in conducting baby-beef clubs which have been organized in 40 counties.

Truck crops.—The principal activities were in increasing and improving home gardens. An effort was made to secure local leadership for this work, and some cities employed garden specialists to assist the movement. Although the campaign was conducted largely through correspondence and publications, it was so successful that a special effort was necessary to conserve by means of drying and canning the large quantities of garden truck produced. An interesting demonstration of the value of irrigating onions was made in Scott County.

Landscape gardening.—The demand for help in landscape gardening developed steadily and became so great that it was necessary to make a limit of one demonstration plan for a community. In co-operation with several county agents a service week was conducted, during which advice was given to groups and individuals in planning the landscape treatment on the grounds.

SURVEY.

The increased number of county agents and county club leaders is indicative of the success of this work in the counties where it has become established. The achievements of the extension division in meeting the war situation, by organizing the farm labor supply, by enlisting volunteer food producers, by locating supplies of seed, and by the campaigns for seed-corn selection and increased agricultural production, all evidence the efficiency of its organization and administration. The growing number of home-economics clubs indicates their value as a means of reaching farm women, and the home-economics instruction of workers in industrial plants offers an equally important method of work with urban women. The record of the baby-beef clubs shows the possibilities of club work, both in the demonstration of economic profit from methods employed and in training boys through their own enterprises as feeders and breeders of live stock. The organization of numerous local groups for the summarizing of farm accounts and the study of the problems of farm management forms a promising method of extension work. As in other States the war situation has accelerated the process of local organization and has brought greater recognition to the value of local leadership.

KANSAS.

Division of College Extension, Kansas State Agricultural College,
Manhattan.

E. C. JOHNSON, *Dean of the Extension Division.*

Organization and administration.—During the year two new departments—county agents and boys' and girls' club work—were organized as separate sections of extension work, with a leader in charge. The highway engineering of the department of rural engineering was transferred on April 1, 1917, to the Kansas State Highway Commission. The dean of the division of college extension acted as head of the department of institutes and demonstrations. He also continued to act as leader of the county-agent work until near the end of the fiscal year, when the assistant county-agent leader was made county-agent leader. A superintendent of institutes and demonstrations was also appointed to begin work July 1, 1917. But little change in organization was necessary to meet the war emergency, the chief problem being to coordinate the work of the division of college extension with that of the State council of defense. This was easily accomplished, owing to the fact that the president of the Kansas State Agricultural College and the dean of the division of college extension were members of the State council of defense and of its important committees. The State council of defense was assisted in making a survey of the seed and labor situations in the State and in locating seed for those sections of the western part of the State where the crop was winterkilled in 1916-17. Food conservation and the necessity for the use of substitutes were emphasized.

Publications.—Nine bulletins and circulars, with a total of 170 pages, were issued in editions of 2,000 to 20,000 copies, the total number of copies being 90,000. Eighteen thousand and 50,000 copies additional, respectively, of the circulars on canning instructions and homemade drying apparatus were issued by the State council of defense.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$36, 685. 00
Smith-Lever, State	26, 685. 00
United States Department of Agriculture, farmers' cooperative demonstration work.....	15, 831. 27
College	52, 580. 21
County.....	17, 066. 67
Other sources within the State.....	5, 257. 55
Total.....	154, 105. 70

Smith-Lever funds were used in support of the following projects: Administration, county agents, home economics, boys' and girls' club work, farm-management demonstrations, extension schools, animal husbandry, poultry demonstrations, dairy husbandry, crops and soils, horticulture, entomology, irrigation and drainage, and hog-cholera control. Funds from the United States Department of Agriculture were used in support of the following projects: County agents, boys' and girls' club work, and farm-management demonstrations.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties covered by agents June 30, 1916, 56; June 30, 1917, 53. The number of county and district agents increased from 19 to 21, the decrease in the number of counties covered being due to reducing the territory covered by some of the district agents. The extension director, who served as county-agent leader, was assisted by two assistant county-agent leaders.

Among the outstanding results of the work during 1917 were the following: Twenty-six thousand nine hundred and seventy-five acres of corn were planted with tested seed and 29,185 acres were grown according to better methods recommended; 67,430 acres of wheat were grown; and 215 farmers cared for orchards containing 23,110 trees. Seven thousand eight hundred and fifteen animals were treated for blackleg and 8,860 hogs were vaccinated for cholera. Several of the agents made special efforts to encourage silo building, resulting in the construction of 467 silos. Four hundred and ninety-eight farmers were persuaded to keep farm accounts. The agents reported that \$107,568 worth of business was handled by farmers' exchanges and other purchasing and marketing associations organized with the assistance of agents, resulting in a saving of \$7,600 to the farmers. The agents arranged for and supervised 989 definite demonstrations, involving 3,713 acres of crops and 6,093 live stock.

To meet the war needs special attention was given to crop and live-stock production. One thousand and eighty farm laborers, 4,050 bushels of seed oats, 4,549 bushels of seed corn, more than 2,00 bushels of kafir seed, and nearly 100,000 bushels of seed wheat were located or secured for 2,080 farmers by agents or through their offices. The corn acreage was increased 26,050 acres and the production more than 200,000 bushels, 74,003 additional acres of winter wheat were sown, and 13,210 additional hogs were raised. As a result of 220 canning demonstrations arranged for by agents, 179,706 additional quarts of vegetables and fruit were canned.

The agents during the year visited 7,110 farms, received 17,209 callers at their offices, and held 3,097 meetings attended by 144,046

persons. Specialists from the State agricultural college and the United States Department of Agriculture took part in 998 of the meetings and demonstrations conducted by the agents.

Home economics.—The work was conducted by a leader and 8 assistants. By December 31, 1917, home-demonstration agents had been installed in 13 counties, the counties having been organized either through the farm bureau or through the county council of defense where no farm bureau existed. Lectures and demonstrations were presented along the lines of food, clothing, house planning, home management, home decoration, hygiene sanitation, home nursing, and child's welfare. The greater portion of the work was presented at 56 extension schools, 25 of which were held in conjunction with agricultural schools. The attendance at the extension schools was 10,088. The dressmaking school was a type of these schools worthy of notice. Twenty women were enrolled in this work. During the first week each received a half day's individual instruction on cutting and fitting a dress, and the second week she brought her sewing machine to the classroom and under supervision completed the garment.

The home-economics extension workers conducted 506 sessions at farmers' institutes, attended by 41,377 persons; spoke at 106 special meetings for women, attended by 5,393 persons; visited 52 high schools and addressed 4,158 students; and judged the exhibits at 26 fairs, making the exhibits a basis for lecture demonstrations. Eighty-five home-makers' clubs, with a membership of 1,843 members, were directed.

During the spring and summer of 1917 campaigns in canning, drying, and the use of war substitute foods were conducted.

The urban demonstration agents carried forward the projects of food conservation in Kansas City and Topeka. A special food conservation campaign was conducted in the former city for three weeks. Daily lectures and demonstrations were given before large groups. Similar information was given to other sections of the State through the cooperation of one of the daily newspapers. A course in war cookery was given in a night school for the purpose of reaching women who could not be otherwise reached. The preservation and economic use of certain foods, the conservation of foods needed for shipment, and the elimination of waste were especially emphasized in the cities.

Boys' and girls' club work.—The work in this State was conducted by one State club leader employed permanently and 25 assistant and county club leaders employed cooperatively on part time and paid from State and department funds. In addition to this 600 volunteer leaders, who receive no pay for their services, were engaged in the work. The club leaders conducted 267 canning demonstrations dur-

ing the year, with a total attendance of 30,482 club members, men and women. In addition, 31 field demonstrations were given, 7 club fairs and festivals, and 29 club exhibits held. One thousand seven hundred and eight club plats were visited by the leaders during the year and 40,000 copies of follow-up literature were sent out by the State. Twelve subject-matter projects were carried out during the year. In the productive completed projects 495 club groups were organized, with a total enrollment of 13,299 members, who reported products valued at \$72,375.14, produced at a total cost of \$25,896.80. Forty per cent of the club groups reporting these products had been in the work the preceding year.

The following table gives some of the more important results regarding the club work:

Summary of results in boys' and girls' club work.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	31	124	152 acres.....	4,858 bushels..	\$7,160.00	\$1,696.32
Potato.....	7	5	1½ acres.....	132 bushels....	174.90	32.00
Home garden.....	59	145	220 square rods.....	.....	977.55	230.30
Tomato.....	9	25	244 square rods.....	.....	693.44	119.18
Sorghum.....	8	6	.....	106 bushels....	106.00	57.50
Home canning.....	8	24	.....	310 quarts, 34 jars jelly.....	225.00	107.00
Mother-daughter.....	199	2,677	40,000 square rods.....	200,931 quarts, 35,748 jars jelly.....	60,050.70	21,500.62
Bread making.....	35	53	.....	2,787 loaves....	418.05	249.83
Garment making.....	85	151	.....	506 pieces, 22-523 darns.....	302.00	227.18
Poultry.....	27	12	347 fowls.....	851 chicks.....	173.50	.....
Pork and crop.....	27	35	76.....	12,691 pounds.....	2,094.00	1,676.87
Total.....	495	3,257	.....	.....	72,375.14	25,896.80

Total enrollment, 13,321.

The outstanding achievement in boys' and girls' club work was the work of the mother-daughter club work. In this there was an enrollment of 7,721 white and 344 colored boys and girls, who grew a total of 40,000 square rods of garden, and canned for home use, in glasses and in tin, 102,477 quarts of fruits, 68,306 quarts of vegetables, 9,028 quarts of meats and soups, and 35,348 glasses of jelly. In addition they canned in glass and tin, and sold 3,900 quarts of fruits, 17,120 quarts of vegetables, 100 quarts of meats and soups, and 400 jars of jelly. The total value of fresh vegetables and canned-food products put up by the mother-daughter clubs was estimated at \$60,050.70, and the total cost of production at \$21,500.62.

Farm-management demonstrations.—The farm-management demonstration work was conducted in 16 counties, five of which were added during the year. Four hundred and ninety farmers were

helped to enter their inventories and to start keeping simple farm accounts. Farm-analysis records were taken on 341 farms and the records for these farms and 138 records taken during the previous year were summarized, returned, and personally discussed with the farmers who gave them.

Extension schools.—The classes of extension schools were conducted during the year, the school in each case lasting five days. At the first-year schools instruction was given in dairying, soil and crops, animal husbandry, domestic science, and domestic art. Thirteen such schools were held covering a total of 129 days with an average attendance at each session of 33 men and 34 women. In the second-year schools, instruction was given in animal husbandry, soils and crops, domestic science, and domestic art. Twelve such schools were held, covering 120 days, with an average attendance at each session of 55 men and 39 women.

Animal husbandry.—The aim of the work during the year was to encourage production of better live stock through modern feeding methods, to encourage the breeding of both cattle and sheep, with a view to using the immense amount of rough feed that is necessarily produced in the growing of grain crops; and to encourage the use of silos and self-feeders. The work was carried on by means of farm tours, management and feeding demonstrations, colt shows, and demonstrations before meetings and at fairs, and also through farmers' institute work. Fifteen colt shows were conducted in cooperation with county agents. At these the qualities of a good draft horse were pointed out and the methods of securing a better grade of horses were discussed. The same line of work was conducted with all classes of live stock at 10 agricultural fairs. The specialist spent two months in giving these demonstrations at county fairs. One hundred and thirty community meetings were held, with a total attendance of 3,960 farmers. These meetings were held on individual farms and local stock was used in the demonstrations. More than 100 head of live stock were transferred from one community to another, with the assistance of a specialist. Special effort was made to encourage sheep raising, and the reports show that 250 registered ewes and between 10,000 and 15,000 grade ewes were shipped into the State in the fall of 1917.

Poultry.—Special emphasis was placed in demonstration meetings on flock improvement and the economic production of eggs through better breeding, feeding, and housing. A "swat-the-rooster" campaign was conducted with marked success. A poultry and dairy train carrying an extensive exhibit of poultry was run for three weeks. Demonstrations and lectures on poultry feeding and management were given at every stop, and approximately 18,000 people were thus reached.

Dairying.—Work was carried on principally along four lines: (1) The developing of dairy centers by aiding the farmers in securing suitable markets. (2) Assisting farmers to lessen the cost of production by better feeding and handling of their cows, the building of silos, and the growing of more alfalfa, clover, and other legumes. The specialist in this work visited 159 farms, and assisted the farmers by working out plans for improving barns, arrangement of buildings, methods of feeding and breeding. (3) Advising on the improvement of sanitary conditions. In connection with this work a survey was made of 69 milk-producing plants supplying milk to Kansas City, Kans. The plants were carefully scored, and suggestions made in regard to improving sanitary conditions and decreasing the cost of milk production. (4) Assistance in selecting, purchasing, and improving dairy cattle. The specialist gave help in the purchasing of 507 grade cows, 9 pure-bred bulls, and 7 pure-bred heifers. Supervision was also given to four active cow-testing associations, involving 80 herds, including 1,000 cows. Three new cow-testing associations were organized.

Soils and crops.—One hundred and thirty-four field-demonstration meetings in soils were held in 18 counties, with an average attendance of 11 persons. Lecture demonstrations were given at 10 five-day schools, the specialist using local soil samples that had been previously analyzed for nitrogen and organic-matter content. The loss of humus as a result of continuous cropping was demonstrated by contrasting samples of continuously cropped soil with soil from prairie-sod land. Twelve special soil-fertility lectures were given at meetings, with a total attendance of 824.

Horticulture and pomology.—Most of the work consisted of one-day or part of day demonstrations in pruning and spraying, about 312 orchards being visited. More extensive demonstrations were conducted in 56 orchards, the specialist visiting the orchard at intervals to point out the pruning and spraying necessary, to teach the life histories of diseases and insects and the methods used in their control, and to compare the results in the portions of the orchard handled in the usual manner and those handled in the way suggested by the specialist. Ninety spraying demonstrations, attended by 400 people, were conducted by the specialist in cooperation with the entomology specialist. Eighty persons adopted some part of the methods demonstrated at these demonstrations. Four packing schools were held for the purpose of instructing growers in better methods of grading and packing, the specialist being assisted in this work by the department of horticulture of the college.

About 12 weeks of the orchard specialist's time was spent in giving instructions and lectures at orchard meetings, fruit growers' conferences, and institutes upon the subjects of fruit growing, garden-

ing, plant diseases, insect control, and marketing. As a result of the lectures and demonstrations more than 600 acres of orchards were set out. It was a noticeable fact that in the orchards where demonstrations had been carried and the trees had been given good care from one to three years under the direction of the specialist, the trees were loaded with fruit, while other orchards produced little or no fruit. Four county automobile tours to the demonstration orchards were conducted for the purpose of comparing sprayed and unsprayed trees; 435 men went on these tours.

Entomology.—The chief work of the specialist in entomology was a field survey in McPherson County to demonstrate the best-known methods for controlling the Hessian fly. The specialist was assisted by a representative of the division of entomology of the college, and in all 306 wheat fields were visited and inspected. The data gathered regarding the time of sowing and the amount of volunteer wheat at the time of sowing in the several fields were assembled, tabulated, and presented to the farms through lectures given at the county school-houses. Nineteen such meetings were held in the county and seven school districts were organized in campaigns to control the Hessian fly. Demonstrations were given before 12 meetings on how to prepare poisoned-bran mash for the eradication of grasshoppers and cutworms. The specialist in entomology also assisted the horticultural specialist by making spraying demonstrations in 17 orchards.

Irrigation and drainage.—Three types of work were done during the year: (1) Planning drainage systems for individual farms to serve as demonstrations, (2) the organization of drainage districts and the giving of engineering assistance to such districts, and (3) assistance to individual irrigation projects. Fifty-five farms were examined during the year for drainage systems and about 100 miles of tile were laid according to plans furnished. Engineering advice, surveys, estimates, preliminary reports, etc., were given or made for 27 drainage-district projects, involving stream improvements, open ditch work, levees, etc.; on 5 storm-sewer problems in towns; and on 7 special flood-control problems involving reservoir and flood questions. Assistance was rendered 47 irrigation enterprises in the western part of the State, chiefly in the form of examination and reports on the efficiency of pumping plants already installed. Thirty irrigation and drainage meetings, attended by nearly 1,300 people, were held during the year.

Hog cholera.—The work was largely of an educational nature, and was carried on by means of meetings held in the schoolhouses of the State. The plan used was to conduct a short, vigorous campaign of one or two weeks in each county by holding meetings in practically all the schoolhouses, and thus reach all the farmers of the county.

OTHER EXTENSION WORK.

Public engineering.—The work was conducted by the college specialists until March, 1917, when it was transferred to the newly created State highways commission. The work was paid for entirely from college funds.

Rural service.—This department of the extension service renders assistance to rural communities along any phase of organized life. During the year 12 community assemblies, each extending through 3 days and 4 evenings, were held, with a total attendance of 26,643 persons. The programs at each of these assemblies consisted of lectures, entertainments, and demonstrations, and were made directly applicable to the war situation. A lecture course including four numbers and a pageant was presented in 29 communities, with a total attendance of 22,159 persons. Fifty-five other addresses were delivered in 45 communities. Community activities were conducted in about 350 communities through correspondence with local leaders, circulating libraries, a rural-life conference, and special campaigns in tree planting, child hygiene, and art exhibits in the rural schools.

Home-study service.—Eight instructors were engaged in this work during the year. The number enrolled for correspondence study was more than double that of the previous year. The scope of the work was extended with a view to assisting teachers of agriculture, home economics, and manual training. Seventy-five high-school teachers of agriculture took the course in agriculture and in addition were assisted in identifying specimens, arranging home projects, and in more closely relating their work to the problems of their respective communities. Fifteen rural teachers took a similar course in agriculture. About 200 blue prints were furnished manual-training teachers for class use, and 25 sets of lantern slides, accompanied by lectures, were circulated throughout the State. Sets of photographs showing the types and breeds of farm animals were placed in 9 high schools. Extension work in home economics was developed in the State prisons, 8 women being enrolled in the work. In the State 5,550 persons were enrolled in reading courses, 520 in extension courses, and 548 in credit courses.

Farmers' institutes.—Work under this project was conducted entirely on college funds. The plan was to send a man specialist and a woman specialist to each meeting. Thirteen extension specialists, 11 home-economics specialists, and 5 representatives of the experiment station were engaged in this work during the year. Eight hundred and fifty sessions with an average attendance of 70 people were held. The specialists devoted in all 900 days to the work and gave approximately 1,800 lectures and demonstrations. Special campaigns were conducted in 14 counties having county agents, 75 of the meetings

being conducted on specific farm-bureau projects. The total attendance in the counties having county agents was 13,489. As a part of the institute work a "Cow and Hen Special" was run in cooperation with the Santa Fé Railroad in the eastern part of the State. A Holstein cow, an Ayrshire cow, a Guernsey cow, a Jersey cow, and an 8-months old Ayrshire bull from the college, and 31 poultry exhibits loaned by farmers and breeders in the eastern part of the State, were carried on the train. Meetings were held at 109 places, with a total attendance of approximately 40,000 people.

Through the cooperation of the district county agent and the Southeastern Kansas Live Stock Association, special live-stock conferences were held at Colby, Scott City, and Fredonia. At Scott City and Fredonia a carload of animals, composed of representatives of the principal breeds of hogs, dairy cows, beef cattle, sheep, and horses was exhibited.

SURVEY.

Extension work has in nearly all lines made good progress during the year. The administration has been strengthened by the employment of an assistant, who will relieve the director of many details, and permit more attention being given to important problems of administration.

The work of the home-demonstration agents is making progress, though the organization work is left almost entirely in the hands of the county agricultural agents and their leaders. The work of the specialists is not as closely correlated with the work of the county agents, as in many States. Specialists in dairying and entomology appear to be doing strong work. The work in the rural service is unique and appears to be doing much toward the establishment of county-agent work.

MAINE.

Division of Agricultural Extension, College of Agriculture, University of Maine, Orono.

LEON S. MERRILL, *Director.*

Organization and administration.—There have been no material changes in the general organization or administrative policy during the year. Owing to the resignation of the assistant director, an executive secretary was appointed to have charge of reports, publications, and statistical data, and otherwise assist the director. In order to increase the efficiency of its workers, the extension department held a conference of all extension workers at the college every 3 months. At these conferences the general policies and needs of extension work were discussed and studied, largely through the work and re-

ports of committees of the conference. Thus the ideas of each member of the staff as to better methods of work and policy were given consideration and, if agreed upon, become the established policy of the department.

Much work was done to meet the war emergency, but no change in organization was found necessary. Most of the county agents served on the county committees of food production and conservation, and in many cases did the greater part of the work. Five of the county agents assisted in making a dairy survey to determine the cost of producing milk, the results of which were compiled by the extension instructor in dairying and the assistant county-agent leader.

Publications.—During the year there were published 5 bulletins aggregating 101 pages, with a total edition of 17,000 copies, and 2 reprints of 28 pages and 9,000 copies; 19 circulars, aggregating 89 pages, with a total edition of 43,125 copies; and 35 news letters, aggregating 98 pages, with a total edition of 20,250 copies. A bulletin mailing list of approximately 5,000 names is in use, which is being classified in such a manner that a bulletin will be sent only to those people who are interested in its subject matter.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal.....	\$18,045.18
Smith-Lever, State.....	8,045.18
United States Department of Agriculture, farmers' cooperative demonstration work.....	4,848.59
College.....	2,016.78
State appropriations.....	1.82
Total	32,957.55

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, farm-management demonstrations and extension schools, poultry, and dairying. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work and farm-management demonstrations.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties covered by agents June 30, 1916, 4; June 30, 1917, 9. Work is supervised by the extension director serving as county-agent leader and one assistant county-agent leader. The farm-bureau plan of organization was adopted in the State and several of the counties were organized in accordance with this plan.

Among the outstanding results during the year were the following: Two hundred and seventy farmers selected seed corn in the fall, 168 farmers tested their seed corn for germination, and 79 orchards were cared for according to recommendations of the agents; 23 registered bulls and 72 registered boars were secured at suggestions of agents; 229 farmers adopted balanced rations, 293 farmers were induced to keep farm accounts, and 216 boys' and girls' clubs were organized, with a total membership of 4,052. The agents arranged for and supervised 420 definite demonstrations involving 341 acres of crops and 483 live stock, and noted the number of farmers who adopted the methods used in the demonstrations.

The agents helped to stimulate an increased production of crops and live stock to meet the war needs. One thousand six hundred and thirty-four bushels of seed wheat, 7,689 bushels of seed oats, and 10,870 bushels of seed potatoes were secured for farmers. Through the efforts of the agents the acreage of oats was increased 4,412 acres, that of corn 1,231 acres, that of potatoes, 5,831 acres, and that of beans, 1,465 acres, thereby increasing the production of oats 37,741 bushels, corn 20,810 bushels, potatoes 288,350 bushels, and beans 12,806 bushels. Eight hundred and forty farmers were assisted in securing 1,207 tons of fertilizers.

In doing the work the agents visited 7,415 farmers and held 890 meetings, attended by 39,049 persons.

Home economics.—Until the war-emergency program was outlined, home-economics extension work was conducted on the same plan as the previous year. This included single lectures, demonstrations, and extension schools. Twenty-one extension schools were held last year, with an attendance of 3,800. The program of the first school in a community was confined to a study of foods with demonstrations of the preparation of single meals, while the program for the second year dealt chiefly with problems of household management. In preparation for the food-conservation work a series of 21 canning demonstrations were held at the colleges and normal schools of the State, with an attendance of 4,636. From these training classes, 53 reported having repeated the instruction in their own towns to an attendance of over 4,000. County canning demonstrations were given at convenient centers to volunteers, who in turn gave similar work in their own towns. During the fiscal year 33 lectures and 84 demonstrations were given, the attendance being 12,304. By the end of December an assistant State leader, 8 district agents, and 1 county agent had been appointed.

The work of the urban home-demonstration agent in Portland is furthered by a central advisory council. The city has been divided into 12 districts with community leaders in each district where weekly demonstrations are given.

Farm-management demonstrations.—Work was conducted in four additional counties, making a total of eight in which farm-management demonstration work is being done. Two hundred and ninety-three farmers began studying their business by starting simple farm accounts. Farm-analysis records were taken on 74 farms, and 51 of these records were summarized, returned, and personally discussed with the farmers.

Extension schools.—The general method of conducting extension schools was the same as in the previous year. All extension workers, including county agents, give instruction in extension schools. The county agents instruct in schools outside of their own counties and thus learn the problems of other workers and methods of solving them. Schools in household management were held for the first time. The outstanding feature of the schools the past year was the new practice of asking all those in attendance to write down the improved farm methods which they expected to adopt as a result of attendance at the school. It is planned to ascertain before the next school is held how many of these new methods have actually been carried out. As a result of this system the county agents now have on file 2,085 written promises that farmers will adopt improved methods in their farm work. Eighty schools were held in 16 counties with a total attendance of 14,079, or 30.6 per session.

Poultry extension.—Poultry extension work was continued along the same lines as the previous year, the most notable advance being the organization of the work with each county agent through a written project statement. During the year 33 demonstrations were completed and 51 were under way at the close of the year. Building bees were held to demonstrate methods of building henhouses and remodeling old houses; 61 buildings were constructed or remodeled according to plans furnished. Sixty-four demonstrations were given in the killing of poultry and its preparation for market, with an attendance of 7,727. Fourteen poultry extension schools were held in eight counties, with an attendance of 2,756. A new feature was a "cockerel futurity test" conducted at the annual show of the Maine State Poultry Association.

Dairying.—Extension work in dairying was impeded by two changes of the extension instructor. A dairy survey to determine the cost of producing milk was conducted with the assistance of the county agents and in cooperation with the State department of agriculture, New England Milk Producers' Association, and Boston Chamber of Commerce. Attention is being given to the organization of small breeders' associations.

OTHER EXTENSION WORK.

Boys' and girls' club work.—The boys' and girls' club work was conducted under seven subject-matter projects, in six of which the work was completed and results reported. The work is supported by funds contributed from outside the State.

The total number of clubs organized in the completed projects was 422 and the total enrollment 6,274 club members. There was an increase over the previous year of 135 per cent in number of clubs and of 218 per cent in number of members. The total value of all products was reported as \$37,738.65, and the total cost of production as \$26,214.75. The club leaders conducted during the year 16 canning demonstrations, attended by 805 club members, women and men, and 43 local club exhibits. One State and 13 county club exhibits were held. The paid leaders were assisted in the work by 412 unpaid volunteer leaders.

The following table gives some of the more important facts regarding the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Members reporting results.	Plat or animals managed.	Product.		
			Amount.	Estimated value.	Estimated cost.
Corn.....	378	95.75 acres....	3,858.5 bushels.	\$9,946.14	\$7,525.62
Potato.....	223	32.91 acres....	4,263.13 bushels.	6,231.46	4,020.44
Home garden.....	468	2,343.54 square rods.	.....	4,100.58	2,206.58
Poultry.....	152	.....	4,803 eggs set..	2,520.55	1,859.38
Pork.....	130	149.....	28,058 pounds.	4,815.66	3,471.01
Home canning.....	410	.....	39,051 pints...	10,124.26	7,171.72
Total.....	1,761	.....	.....	37,738.65	26,214.75

Total enrollment, 6,274.

Lecture service.—The object of this project is to give instruction by means of lectures and lecture demonstrations on subjects pertaining to agriculture, forestry, and home economics, given by the faculty of the college of agriculture on request of the county agents and various organizations. During the year 161 lectures were given, attended by 16,024 people.

Forestry extension.—A forest examiner of the Forest Service, United States Department of Agriculture, studied the marketing of farm woodlot products in Maine during the year and prepared a bulletin upon the subject, which was published by the extension service.

SURVEY.

The effective organization of the extension division is being further integrated by more frequent conferences of the whole staff. The

adoption of the farm-bureau plan of organization in several counties where agents have been placed for the first time should enable the county agents to further increase the efficiency of demonstrations when supported by the definite follow-up work, which Maine has so well developed. The home-economics leaders of Maine have capitalized the increase of volunteer leadership due to the war. By training these volunteers in normal classes, demonstration work in home economics was largely and effectively increased. New methods of following up the results of extension-school teaching have given the extension school more dynamic value and made it an integral feature of the county agricultural program. The coordination of work between the poultry specialist and county agents by means of definite project agreements initiates a method which is probably desirable for all phases of extension work and the poultry-house building bees show how one of the most ancient human customs may form an important feature of extension pedagogy. The increased number of boys' and girls' clubs and their enlarged membership was a result of the very general enlistment of voluntary local leadership under the supervision of paid leaders. The leadership which the county agents furnished to county committees on food production and conservation and its very general acceptance, was but a recognition of the place which the extension force occupies in organizing Maine agriculture.

MASSACHUSETTS.

Division of Extension Service, Massachusetts Agricultural College, *Amherst*.

WILLIAM D. HURD, *Director*.

Organization and administration.—No important changes of organization or administrative policy were made during the year, though there were an unusual number of changes in the personnel of the staff due to war conditions. Upon the resignation of the assistant director, the position was changed to that of assistant to the director. The cooperative relations with other organizations mentioned in the last report have been maintained.

Immediately upon the formation of the committee on food production and conservation of the Massachusetts Committee on Public Safety, the extension service as a part of the college was placed at the disposal of the committee, and every member of the extension staff helped the work of the committee in some way. A few members of the staff devoted all of their time to this work for several months. A sum of approximately \$35,000 was set aside by the committee for the support of county agents, home-economics work, and boys' and girls' club work. These funds were handled through the county councils of public safety who closely cooperated with the farm bureaus. During the season to increase production, active campaigns

were carried on for home gardens, poultry, milk, and potato production, in which every county in the State was covered. Various members of the college staff, not regularly employed by the extension service, assisted in these campaigns, and the whole staff of some departments were at times engaged in extension work.

Publications.—During the year there were published 866,000 copies of extension circulars, 24,000 extension bulletins, and 3,000 library leaflets; 106 new letters were issued, as well as several posters, charts, and announcements. The use of a general mailing list for the distribution of extension publications has been discontinued.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$15,373.04
Smith-Lever, State.....	5,373.04
United States Department of Agriculture, farmers' co- operative demonstration work	15,012.96
Bureau of Animal Industry.....	2,688.54
State appropriations.....	52,749.49
County.....	55,846.00
Total	147,043.07

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, farm-management demonstrations, extension schools, animal husbandry, dairying, poultry, and pomology. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, home economics, boys' and girls' club work, farm-management demonstrations, animal husbandry, and poultry husbandry.

A detailed statement of expenditures and receipts has been received and approved.

County-agent work.—Number of counties with agents June 30, 1916, 9; June 30, 1917, 11.

Among the outstanding results of county-agent work in Massachusetts during 1917 were the following: Five hundred and eighty-six farmers selected seed corn in the fall, 867 farmers treated seed potatoes to control potato diseases for a total of 2,142 acres; and 1,477 cows were under test in associations organized by agents in previous years, resulting in 478 cows being eliminated during the year as unprofitable. Purchasing and marketing associations organized with the assistance of agents are reported to have done \$119,850 worth of business and to have saved the farmers more than \$11,000. Two hundred and thirty-nine boys' and girls' clubs were organized by the agents, with a total membership of 11,362. One hundred and forty-nine demonstrations were conducted.

In March, 1917, all plans for regular demonstration work were laid aside and the work for the season planned on the basis of war-time needs. Surveys were taken in cooperation with the agricultural college to determine the State's needs in seeds, fertilizers, labor, and credit. More than 400 meetings were held by the agents during April and May to stimulate increased crop acreage. In addition, many conferences were held with town committees on food production since they turned to the county farm bureaus and the county agents for guidance in their activities. Many farm bureaus found that financial assistance was needed by farmers in order to increase their crop acreage. Three counties reported assistance rendered to the extent of \$15,000. In one county, through the efforts of the farm bureau, a fund of \$100,000 was pledged by the business men of the county to underwrite loans of banks to farmers needing credit. In another county 10 manufacturers underwrote a fund of \$100,000, used to guarantee a price of \$1.50 per bushel to potato growers and \$6 per bushel for beans. Since the price of these products was higher at harvest time than the amount pledged, this fund was not drawn upon.

The following are some of the results obtained: Nine hundred and ninety-three laborers, 3,100 bushels of seed corn, and 2,130 bushels of seed rye were secured or located with the assistance of agents. The acreage of corn was increased 30,796 acres, bringing about an increased production of more than a quarter of a million bushels. The acreage of beans was increased 2,078 acres, thereby increasing the production of beans by practically 25,000 bushels. One thousand nine hundred and fifty farmers were assisted in securing 37,050 bushels of seed potatoes and the acreage of potatoes was increased by 8,775 acres, thereby increasing the production by more than 500,000 bushels. Assistance was given to 1,397 farmers in securing 2,822 tons of commercial fertilizers. The campaign for increased livestock production resulted in an increase of 7,715 in the number of hogs raised. Twenty-eight public markets were established, and are reported to have done \$267,445 worth of business. Five hundred and twenty-six farmers were assisted in securing credit for purchasing machinery, seed, etc. To bring about increased food conservation, 297 canning demonstrations for women were held, resulting in more than 600,000 additional quarts of fruit and vegetables being canned.

The agents made 3,613 visits to farms and held 983 meetings, with an attendance of 71,944 persons. The associations organized to cooperate with the agents had, on December 1, 1917, a membership of 8,419.

Home economics.—Four additional workers were added to the regular staff of two State workers, as the need of organizing work in the counties was so great that they were unable to meet the demands. In 1917, six additional counties organized departments of the farm

bureau for home-demonstration work and agents were placed at work. In November, 1917, agents began work in two more counties, thus making the county organization in Massachusetts complete with a home-demonstration agent in every county except Suffolk, which comprises Boston.

Thirteen extension schools of four and one-half days each were held during the year, with an attendance of 2,997. Outlines were given the women at each lecture and demonstration. The cooperation of the women was asked for in checking certain cooperative enterprises, such as following suggestions of the food chart; using new recipes or adopting old ones; canning more vegetables; endeavoring to establish a hot school lunch; bettering home sanitary conveniences; making kitchen more convenient; doing definite reading or studying in home economics; and holding a "better babies" day. As a piece of follow-up work the women were later asked how far they carried out these suggestions. At the end of the courses six new study groups were formed and programs suggested for groups already organized. Loan libraries were sent for use of the women in their study. Twenty-seven home-economics clubs were formed, with a membership of 719. An extension school of unusual type was held in cooperation with the Essex County agricultural school. Two or more representatives were sent to the school from each town in the county. The women actually took part in the work and volunteered as instructors in their own communities at the close of the school. One hundred and twenty-six lectures and demonstrations were given, with an attendance of 5,248. During the summer 74 one and two day schools were held throughout the State, with an attendance of 9,299. Instruction was given in foods, canning, drying, and storage. Three schools of one week each for training leaders were held in July at the college, where opportunity was given for laboratory work, canning in glass and tin with both home and community equipment, the drying of fruits and vegetables, and winter storage of vegetables. Another school for the training of leaders was held on the campus in the fall.

By December 31, 1917, Massachusetts had 11 cities organized for urban home-demonstration work—more than any other State—the cities having met this new type of extension service with strong financial and cooperative support. The city work was directed by a State leader for urban work with two assistants. The city organization included a representative executive committee with community committees in each district into which the cities have been divided, the community center being the school. The program for each district was adapted as indicated by a study of its needs. The home-demonstration agents served to help coordinate the work of various food-conservation agencies in the cities and thus to avoid duplication of effort. The program of work included educational work on

food conservation, and cooperation was given by libraries, schools, churches, chambers of commerce, newspapers, women's clubs, farm bureaus, municipal health boards, industrial plants, and retailers. Food-conservation centers were established for demonstrations, conferences, exhibits, and the distribution of literature and information. Successful efforts were made in reaching foreign women through their own natural leaders. In one city 17,039 foreign women attended 469 demonstrations on food conservation. Special attention has been given to teaching mothers how to feed their children, to the establishment and improvement of school luncheons, and to the food problems of the large industrial populations in the State.

Boys' and girls' club work.—Seven hundred and ninety-six club groups were organized, with a total enrollment of 99,649. Of this number, 250 were emergency war-garden clubs, with a total enrollment of 90,000. No complete records were received on the results of these war gardens. The value of all products reported in the four completed projects was \$12,158.71 and the total cost of production \$4,017.35. The work was conducted by a State leader, 2 assistant leaders, and 9 county leaders. One assistant leader and 4 county leaders were hired on emergency funds and 367 volunteer leaders gave considerable time to the work. Only four were employed permanently on a salary paid from cooperative funds. The public safety committee of Massachusetts furnished funds which permitted the employment of extra workers in the early spring, making possible a very considerable expansion of the work which aided in the campaign for increasing food production and conservation. During the year the club leaders conducted 53 canning demonstrations, 75 field demonstrations, and 211 exhibits. From December 1, 1916, till the close of the following canning season approximately 58,664 people attended demonstrations and meetings held by the State club leaders. The club leaders visited during the year 2,169 club plats. Fifty thousand copies of follow-up instruction were prepared for club members and distributed during the year.

The following table gives some of the more important items regarding the club work:

Summary of completed projects of boys' and girls' clubs.

Project.	Clubs organized.	Members reporting results.	Plats or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	27	8	7.5 acres.....	600 bushels....	\$1,397.78	\$338.82
Potato.....	43	20	3.7 acres.....	845.25 bushels..	1,671.76	455.24
Market garden.....	53	81	6 acres.....	.....	4,474.81	1,072.70
Poultry.....	62	133	2,367 hens.....	11,536½ dozen eggs	4,614.36	2,150.59
Total.....	195	242	.....	.....	12,158.71	4,017.35

Total enrollment (including war gardens), 99,649.

Farm-management demonstrations.—Work was conducted in nine counties during the year. The farm-management demonstrator devoted considerable time in assisting county agents and other leaders to determine the cost of producing milk in Massachusetts. In this connection 200 farms were studied and the cost of producing milk determined. Much time was devoted to farm-labor problems in the spring and summer. Farm-analysis records were taken on 113 farms. These were summarized, returned, and personally discussed with the farmers. One hundred and seventy-two farmers began studying their farm business by starting simple farm accounts.

Extension schools.—Nine extension schools were held, one being devoted entirely to home economics, and eight to agriculture and home economics. The attendance at the agricultural extension schools was 378 with an average of 24.6 persons per session, and at the home-economics schools 500 were in attendance, an average of 27.7 per session.

Animal husbandry.—This work was carried on by the entire staff of the animal-husbandry department, including the entire time of the extension specialist. Instruction was given at eight extension schools at six of which a week's course in animal husbandry was given. A special effort was made to visit the farms of those attending the schools and give them advice on live-stock management. Difficulty was experienced in maintaining cow-testing associations and one was forced to discontinue, owing to the scarcity of satisfactory testers. Sixty herd owners, who had not previously kept records, were supplied with daily milk-record sheets. Live stock was judged at 11 fairs. Fourteen stock-judging contests, in which 200 boys participated, were supervised. Work in sheep industry was started in cooperation with the Bureau of Animal Industry, United States Department of Agriculture, and the Rhode Island State College, a specialist being in charge of the work in the two States. The object is to aid farmers in building up the sheep industry by helping them to secure breeding stock, advising on various problems of management, and in trying to secure fair and adequate dog laws.

Dairying.—The most important work of the past year was the holding of two dairy shows and four quarterly scorings for dairy products. This work was carried on with the cooperation of the Massachusetts dairymen's association, Massachusetts milk inspectors, the Massachusetts board of agriculture, the Eastern States exposition, and the United States Department of Agriculture. It is felt that such shows and the scoring of samples purchased by inspectors on the open market form one of the best means of improving the milk supply of a town or city. A large piece of work was the collecting and tabulating of data on the cost of milk production in a survey in which the New England Milk Producers' Association and Bos-

ton Chamber of Commerce cooperated. Under a cooperative arrangement with the Bureau of Animal Industry of the United States Department of Agriculture, demonstrations and lectures on the home manufacture of soft cheese were given in various parts of the State.

Poultry.—A week's work in poultry husbandry was given at each of nine extension schools. Several field meetings were held, at which 10 to 12 poultry men gathered at a specified plant selected for some particular feature. The visitors were shown the details of the plant and criticisms were made of the methods employed. The rapid increase in the cost of feed, with the general market conditions, created a feeling of uneasiness among producers. The Massachusetts committee on public safety provided funds with which the extension service was able to place 10 well-trained men in the field who emphasized the importance of retaining producing stock. Six thousand people were reached by lectures, 480 farms were visited, and a general feeling of confidence was reestablished.

Pomology.—The principal work in fruit growing consisted in the demonstration of all seasonal operations in the 13 orchards under contract for a period of years. Several pruning and spraying demonstrations were conducted. Eight extension schools were held, with an attendance of 240 people. Ten 2-day meetings were held for instruction in evaporating and storing fruits and vegetables and one apple-packing school were held.

OTHER EXTENSION WORK.

Cooperative organization and marketing.—Under the supervision of the department of agricultural economics of the college, and with the assistance of the county agents, an agricultural census was made of the five western counties of the State. These data were summarized carefully and filed with the county farm bureaus. In cooperation with the attorney general of the Commonwealth, a study was made of the cost of distribution of milk by small dealers in Boston and vicinity for the purpose of determining a fair price to the consumer. Assistance was given in the formation of 12 cooperative farmers' organizations, including 5 cooperative exchanges. Advice and assistance were given many other organizations, and better business methods were taught. A market exchange clearing through the extension specialist from the county agents was established; it will be developed gradually and will inform the agents where high-grade animals, seed, etc., may be bought and sold.

Community organization.—The supervision of organization was continued or started in 36 towns, and 11 towns are organized completely or partially. A new council of county organizations was organized in Essex County and preliminary work was done for

councils in four other counties. Surveys were made by three counties, showing the organizations of each town and what each was doing, and a preliminary agricultural survey to show the principal needs of each town, and outlining the next step which seems necessary for its development.

Correspondence courses.—Correspondence courses were continued as in past years. A special effort was made to bring individual students into study groups, which were met by members of the college faculty for lectures and answering questions concerning problems encountered. Seven hundred and thirty-three students were enrolled in 18 correspondence courses.

Beekeeping.—The principal activities were in fair exhibits, and five beekeepers' field days and conventions during the summer. A four-day beekeepers' school was held with 50 in attendance.

Rural civic planning.—In spite of the war there was an increased demand on the part of communities for civic planning. During the year two lines of work were emphasized, visits and general surveys of small rural communities followed by reports including specific recommendations for the development of public tracts within the town, and further assistance to public institutions. Many of the plans made for the latter last year were followed this year in construction work. The projects were confined to strictly public enterprises, and the expenses for travel and for drafting the plans were paid by the communities or organizations served.

SURVEY.

The efficiency of the extension service and its peculiar qualifications for organizing agriculture in the war emergency were recognized by the State through the financial support given the enlarged extension force by the committee on public safety. This was justified by the systematic manner in which the extension service surveyed the agricultural situation, and by the successful campaigns which it then conducted for increased food production and conservation. The use of county extension schools for training local demonstration leaders by the home-economics department may well be tried in other lines of extension work. The urban work in home-economics extension has been conceived on broad lines, and made an auspicious start. The large enrollment of boys and girls in war gardens indicates able leadership alive to adapting methods to meet the emergency situation. Conducting a State sales exchange in cooperation with the county agents by the State marketing specialist was an innovation in extension work, and the results will be of wide interest and significance. Massachusetts continues to lead in developing methods whereby the extension service may initiate better community organi-

zation and civic planning, a public service much needed during war, when activities are largely determined by the integration of the public opinion of the community.

MICHIGAN.

Division of Extension, Michigan Agricultural College, East Lansing.

R. J. BALDWIN, *Director*.

Organization and administration.—No material changes were made in the general plan of organization or administration. To relieve the director of certain office work, an administrative assistant was appointed, who also has charge of the extension schools.

When war was declared and the importance of increasing food production was evident it seemed desirable to place an agricultural agent in each county in the State in addition to the 30 then employed. A request was made to the State war preparedness board for funds to employ 38 emergency agents from May 1 to October 31. The request was granted, and the men were employed as joint agents of the extension department and the war preparedness board. A special publicity office was established April 1 for furnishing the press of the State with timely articles on food production.

Publications.—The following publications were issued during the year: Four bulletins, with a total of 28 pages and a total edition of 35,000 copies, and 7 Extension Course Notes, with a total of 80 pages and a total edition of 70,000 copies.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$43,059.35
Smith-Lever, State	33,059.35
United States Department of Agriculture, farmers' cooperative demonstration work	22,712.66
Bureau of Animal Industry	465.00
Bureau of Markets	300.00
College	15,080.21
County	5,866.47
Total	120,543.04

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, farm-management demonstrations, extension schools, farm-crop demonstrations, animal and dairy husbandry, horticulture, potatoes and vegetables, control of insect pests, household engineering, and forestry. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, home economics, boys' and girls' club work, farm-management demonstrations, animal and dairy husbandry, and marketing.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents June 30, 1916, 22; June 30, 1917, 30. Work was supervised by a county-agent leader with two assistants.

Among the outstanding results during 1917 were the following: Three thousand seven hundred and sixty-nine farmers selected seed corn in the fall and 3,325 tested seed corn, resulting in 10,981 acres being planted with seed tested for germination; 13,606 farmers treated the seed oats used on 98,273 acres for smut; 10,103 acres of potatoes were planted with treated seed by 2,392 growers; 328 farmers were induced to sow 2,156 acres of alfalfa, and 175 farmers raised 4,271 acres of vetch. Special emphasis was laid on using improved varieties of rye, and 1,060 farmers followed suggestions along this line. In order to improve dairy herds, the agents were instrumental in having 202 registered bulls and 201 registered cows secured. Seven cow-testing associations were organized, and 4,850 cows were under test in associations organized by agents during 1917 and in previous years, resulting in 341 cows being eliminated as unprofitable. Eight live-stock breeders' associations and 11 hog-cholera control clubs were also organized. The silo campaign conducted in several counties resulted in 338 additional silos being built. Eighty-three drainage systems were planned and installed, bringing about the drainage of 3,819 acres of land. Two thousand eight hundred and eighty-seven farmers supplemented barnyard manure with acid phosphate or ground-rock phosphate, and 5,642 tons of commercial fertilizers were used at suggestions of agents. Fifty-six local sources of lime were developed, and 12,365 tons of limestone were used. Twelve thousand one hundred and sixty-four acres of clover were plowed under for soil improvement. Eight hundred and thirty-four farmers were induced to keep farm accounts. It is reported that practically \$1,500,000 worth of business, with a saving of \$69,600 to the farmers, was done through the 15 farmers' exchanges and 36 purchasing and marketing associations organized with the assistance of agents. Three hundred and nineteen boys' and girls' clubs were organized, with a total membership of 4,278, and 314 extension schools, including farmers' institutes, with an attendance of 20,115, were held or arranged for with the assistance of agents. One hundred and forty-one agricultural observation tours, attended by 1,938 persons, were conducted. The agents conducted 3,267 definite demonstrations, involving 49,138 acres of crops and 1,649 live stock.

In order to stimulate crop and live-stock production to meet war needs the Michigan Legislature, by special appropriation, provided

funds for hiring special agents to carry on the emergency work until the Federal appropriations were available. Thirty-eight such agents, covering 52 counties, were placed about May 1.

In connection with the definite campaigns conducted, the agents assisted farmers in obtaining 3,476 laborers, 65,485 bushels of seed corn for the 1918 crop, 12,584 bushels seed oats, 5,700 bushels of beans, more than 35,000 bushels of seed wheat, 47,143 bushels of seed rye, and 34,755 bushels of seed potatoes. As a result of these campaigns the oats acreage was increased 14,112 acres and the production practically a third of a million bushels; the potato acreage, 11,950 acres and the production more than 1,000,000 bushels; the bean acreage, approximately 20,000 acres and the production more than 100,000 bushels; the wheat acreage, more than 20,000 acres; and the rye acreage, 11,877 acres. The campaign for increased production of live stock resulted in the number of cattle being increased 1,435, the number of hogs 4,412, and the number of sheep 6,237 and in 1,050 calves being saved from slaughter. One thousand two hundred and ninety-seven farmers were assisted in securing credit for purchasing machinery, seed, etc. Fifty-nine farm-loan associations were organized with the assistance of agents. In the campaign for food conservation the agents arranged for 448 canning demonstrations, which resulted in more than 100,000 quarts of fruit and vegetables being canned.

In doing the work the agents visited 21,586 farmers, received 19,297 calls at their offices, and held 3,336 meetings, attended by nearly 200,000 persons.

Home economics.—For the first half of the year the principal lines of activity were the extension schools and single demonstrations. Thirty-five extension schools were held with an attendance of 2,205; 172 lectures and demonstrations were given with an attendance of 12,159.

After war was declared it was apparent that the staff could not meet the demands, so volunteer workers were called for and a week's training school was held. One hundred women who had had at least two years' home-economics training responded. Twelve thrift lessons were prepared by the home-economics department and given to thrift clubs, which were conducted by local leaders. One hundred and twenty canning demonstrations were given by paid and volunteer leaders with an attendance of 5,155.

An assistant State leader was appointed for the Upper Peninsula, which consists of 16 counties. This territory was divided into five districts, and three home-demonstration agents were employed. Special schools were held for the Finnish women, and bulletins were translated for their use. In the Lower Peninsula, where there is a larger population, the home-demonstration agents were placed in counties.

Seven counties and 2 cities had agents, making a total of 14 workers in the State.

Urban home-demonstration agents were at work on food conservation projects in Grand Rapids and Flint prior to January, 1918. In Flint the city was divided into districts coincident with political wards and a demonstration center was established in each. Other demonstration centers have been started in cooperation with the Y. W. C. A. for night classes on foods and clothing for girls in the factory districts. Plans were made for cooperation with a home-economics instructor in the public schools.

Boys' and girls' club work.—The club work was in charge of a State club leader, 4 assistant leaders, 3 district leaders, 21 paid county leaders, and 682 voluntary leaders. The county leaders and 2 assistant and 2 district leaders were paid cooperatively from war-emergency funds. Thirty county school commissioners, 31 county agricultural agents, and 14 Y. M. C. A. secretaries assisted in organizing the clubs and carrying on the work. During the year 277 canning demonstrations were given with a total attendance of 31,261 club members, women and men. Three hundred and eighty-seven field demonstrations, 104 club festivals, and 337 club exhibits were conducted. Twelve training schools for leaders, attended by about 500 persons, were conducted during the year. The club leaders visited 3,935 club plats.

The total number of clubs organized in all projects was 1,025, with a total enrollment of 16,428. Sixty-five per cent of all club groups were organized and did effective work the year before. In the 10 completed projects of work the 8,061 members who reported results raised \$69,537.97 worth of products at a total cost of \$29,207.56.

The following table gives some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plats or animals managed.	Products.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	83	169	123.35 acres....	6,353 bushels..	\$7,740.50	\$2,373.00
Potato.....	77	316	122.4 acres.....	13,792.3 bushels	15,235.88	5,511.12
Home garden.....	156	6,561	10,289.1 square rods.		31,720.38	12,657.86
Beans.....	96	62		318.4 bushels..	2,547.20	1,025.50
Poultry.....	33	23		674 chicks, 139 dozens eggs.	422.25	212.13
Pork and crop.....	12	61	64	6,337 pounds..	1,606.68	1,170.38
Canning.....	28	350		19,477 quarts..	6,648.77	4,548.04
Garment making.....	441	436		1,847 pieces....	3,409.31	1,569.18
Cooking and home economics.	8	32		5,832 dishes....	102.00	80.35
Handicraft.....	22	51		179 articles....	105.00	60.00
Total.....	956	8,061			69,537.97	29,207.56

Total enrollment, 16,428.

Farm-management demonstrations.—Work was conducted in 25 counties during the year. The plan of the work was to spread it over a larger area than in former years. Local leaders, county agents, and high-school teachers cooperated in teaching farmers how to keep simple farm accounts. One thousand one hundred and twenty-one farmers began studying their business through simple farm accounts. One hundred and eighty-one farm-analysis records taken the previous year were summarized and returned personally to farmers. As a result of farm-management demonstration work, 131 farmers changed their management in order to increase the net returns from their farm business.

Extension schools.—Fifty-nine agricultural-extension schools were held, with a total enrollment of 3,731 and an average attendance of 48, and 35 home-economics extension schools, with a total attendance of 2,205 and an average attendance of 35. The general plan of the schools was the same as in 1915-16.

Farm crops.—Extension work in farm crops was done chiefly under the pedigreed-grain project. The work was carried on chiefly through the Michigan Crop Improvement Association, a reorganization of the Michigan Experiment Association, which now has 37 local associations and a total membership of 902. During the year 1,515 cooperative tests were carried on with members of the association. The association arranges for the inspection of fields for seed, the cost of which is borne by the members. The specialist conducts an exchange service for the purchase and sale of the improved varieties but handles no money. Inspected fields of Red Rock wheat averaged 30 bushels per acre, as compared with 22 bushels for other varieties. The average of this variety increased from 600 to 6,000 acres, and the whole crop will be sold for seed. Cooperative tests with Rosen rye, winter barley, pedigreed oats, and corn were also conducted. Twenty demonstrations were held, instruction was given at 20 extension schools, and 40 lectures were given to 1,652 people.

Animal and dairy husbandry.—The organization of breeders' associations continued to be the principal work under this project, 5 county and 10 community breeders' associations being organized during the year. Through the cooperation of a local banker and the county agent, all grade bulls in service were eliminated from Wexford County. Forty-three demonstration meetings, with an attendance of 863, and 37 lecture meetings, with an attendance of 2,363, were held by the live-stock specialist during the year, and instruction was given at 11 extension schools. Work in the supervision of cow-testing associations was carried on in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture. The 10 associations existing last year were reorganized and 5 new associations organized, the 15 associations embracing 408

farmers with 5,642 cows. Concrete evidence of the value of these associations is increasing and is responsible for their continuance. Ninety-seven lectures and 12 judging demonstrations were given and 490 farm visits made by the dairy specialist.

Horticulture.—The work with apples, peaches, plums, grapes, and small fruits included pruning, spraying, grafting, thinning fruit, cover crops, and the grading and packing of fruits. As far as possible, the work was followed up by carrying on the various lines in the same place. Proper packing of fruits in order to comply with the Michigan fruit-packing law was stressed. Seventy-nine demonstrations were held, with 1,008 in attendance, 96 lectures were given, with an attendance of 6,637, and 202 farm visits were made.

Potatoes and vegetables.—The work with potatoes in the Lower Peninsula included demonstrations of the tuber unit method of seed improvement, hill and field selection for seed, treatment for scab and green-sprouting of seed, close planting of seed, fertilizing, and spraying. The work was carried on by the county agents cooperating with small local groups or local associations rather than with individuals. Hill-selected seed increased the yield 25 bushels per acre. Acid phosphate alone increased the yield 20 to 25 bushels per acre. Fifty-seven field meetings and demonstrations were attended by 800 growers, and 52 lectures, attended by 5,122 people, were given.

Control of insect pests.—One hundred and fifty-nine farms located in all parts of the State were visited in response to requests for advice as to the control of insect pests, and 10 demonstrations were conducted, including a successful demonstration of the use of heat for the control of insects in a flour mill. The pear psylla and cutworms were pests dealt with chiefly.

Household engineering.—There was a growing interest in this work which evidenced real progress made. One community in Kent County, where the construction of septic tanks was explained three years ago, has now installed 25 tanks. A small exhibit of septic tanks and a water system was made at several fairs. Assistance was given in planning drainage systems and the remodeling of farm houses.

Forestry.—The extension work in forestry was done largely through the county agents during the late fall and early winter months. Since entire farms have been lost by sand dunes, much attention was given to holding these dunes in check by planting trees. The leader gave directions in person to the agents and sent them trees and grass seed, and they directed the farmers in methods of planting or sowing; 12 such demonstrations were conducted during the year, one or two being located in each county having difficulty with sand dunes. A beginning was made in woodlot-demonstration work, and timber was marked for cutting on several farms by the specialist. Two demonstrations are being conducted in growing

basket willows. Christmas-tree planting has now become a commercial success, and the county agents established many plantations. Some work was done in the development of the maple-sirup industry, several associations being started near six small towns in three counties; 10,000 gallons of sirup went on the market as a result of this work and much better prices were secured than where individuals sold in small lots.

OTHER EXTENSION WORK.

Marketing farm products.—This project was conducted by the State market director and the Bureau of Markets, United States Department of Agriculture, which furnished an assistant. Field work in marketing was carried on in 34 counties. Assistance was given in the organization of seven cooperative associations and in reorganizing eight existing associations, so that they might incorporate as noncapital stock, nonprofit associations. Temporary organizations which later may become permanent were formed in six counties. Informal audits of the business of several organizations were made and as a result many are installing the uniform system of accounts devised by the Bureau of Markets. Assistance was given in the formation of the Michigan Fruit Packers' Federation, which, with laws enacted by the legislature, did much for the standardizing and grading of orchard fruits. It is estimated that the advice given under this project for the marketing of the bean crop in 1916 increased the profits to the growers by two to three million dollars. During the year the Michigan Milk Producers' Association was organized and was instrumental in so increasing the price to producers that it is estimated the yearly earnings of every man whose daily output of milk was 250 pounds were increased over \$400.

SURVEY.

During the year the extension work more than doubled. The employment of new county agents by the War Preparedness Board recognized them as the official agency for the promotion of increased agricultural production, and the gratifying results of the campaigns for larger acreages and yields justified the confidence placed in them. The utilization of volunteer workers who had had some academic training in home economics by means of short courses in extension methods is a practical means of meeting a war situation. Holding numerous schools for the training of club leaders is another step in the method of developing local leadership. The success of the Crop Improvement Association in introducing new varieties of grains and the relation of the agronomy extension specialist to this work furnish an example of a fertile field for extension work. It is to be

commended particularly as a fortunate adaptation of methods to meet local needs.

The emphasis given to extension work in marketing met a very real demand for assistance in problems of distribution always more acute under war conditions. It is a line of work in which Michigan is showing that the extension forces may be of very real service.

MINNESOTA.

Agricultural Extension Division, College of Agriculture, University of Minnesota, University Farm, St. Paul.

A. D. WILSON, *Director*.

Organization and administration.—There were no changes in the general plan of organization from that of the previous year. The director of the extension division was appointed chairman of the committee on conservation of food products of the State public safety commission. The commission financed the entire food conservation work, so that no additional persons were employed temporarily by the extension division for war-emergency work. Both the live-stock breeders' association and the State dairymen's association cooperate in the financial support to extension projects affecting their interests.

Publications.—Forty-one extension publications, with a total of 445 pages and a total edition of 406,700 copies, were issued during the year. This included the Minnesota Farm Bureau News, which is bi-monthly, in an edition of 1,500 copies; the University Farm Press News, which is published semimonthly; and eight numbers of the Minnesota Farmer's Library in editions of from 10,000 to 75,000 copies.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$37,314.81
Smith-Lever, State	27,314.81
United States Department of Agriculture, farmers' co- operative demonstration work.....	15,025.47
Bureau of Animal Industry.....	2,157.85
Bureau of Markets.....	800.00
College	12,011.19
State appropriations	24,250.43
County	13,859.78
Other sources within the State.....	6,391.22
Total	139,325.56

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls'

clubs, extension schools, farm-management demonstrations, demonstration farms, cow testing, dairying, horticulture, plant pathology, poultry husbandry, and soils. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, boys' and girls' clubs, farm-management demonstrations, cow testing, dairy manufactures, and marketing.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents June 30, 1916, 19; June 30, 1917, 16. The work was supervised by the county-agent leader and one assistant.

Among the outstanding results during 1917 are the following: Twenty-three thousand six hundred and sixty acres of corn planted with fall-selected seed, and 24,345 acres planted with seed tested for germination by 1,134 farmers; 793 farmers treated their seed potatoes for diseases, resulting in 12,420 acres being planted with treated seed; 3,903 acres of alfalfa were sown by 770 farmers. Considerable attention was given to live-stock improvement; 183 registered bulls were secured; 6 cow-testing associations were organized and 2,702 cows tested, resulting in the elimination of 448 cows as unprofitable, and 11 live-stock breeders' associations were organized with 254 members. Two hundred and ninety-five silos were built at the suggestion of agents, and 106 drainage systems were planned and installed by farmers to drain 9,012 acres. Three hundred and fifty-four farmers were induced to keep farm accounts and 36 farmers' clubs were organized with a membership of 2,015. The purchasing and marketing associations organized with the assistance of the agents, including several live-stock shippers' associations, did more than \$2,000,000 worth of business, on which the members were saved more than \$240,000.

The agent arranged for and conducted 1,026 demonstrations, involving 2,995 acres of crops and 8,646 live stock. The demonstrations on crops dealt principally with the control of potato diseases, drainage, orcharding, and cooperative marketing. The agents also conducted special campaigns to increase crop and live-stock production to meet war needs. One thousand five hundred and forty-six laborers, 6,980 bushels of seed wheat, 10,877 bushels of seed oats, and 13,870 bushels of seed potatoes were secured or located for farmers. Wheat grown was increased 25,140 acres and the production nearly a third of a million bushels; oats, 32,087 acres and the production about 662,055 bushels; barley, 15,119 acres and the production nearly 500,000 bushels, and the production of potatoes practically 500,000

bushels. The number of sows bred was increased by 1,520, and 2,015 sheep were placed on farms. Assistance was given in the organization of 14 farm-loan associations. One hundred and seventy demonstrations were arranged for adult women, resulting in 333,325 additional quarts of fruit and vegetables being canned. In doing this work, the agents made 6,298 farm visits, and took part in 1,455 meetings attended by 129,045 persons.

Home economics.—A State leader, three urban workers, and nine district home-demonstration agents have been at work on the home-economics-extension program since the war emergency. Prior to that specialists gave lectures and demonstrations before women's organizations at meetings of farmers' clubs. Early in the fall of 1917 2-day short courses in food conservation were held in each county. These were followed by 5-day courses in districts where further work was desired. A food-conservation exhibit was held at the State fair. Demonstrations were given each day on the conservation of wheat, meat substitutes, adequate feeding, and home nursing. Similar demonstrations were given at 33 county and district fairs. During October 1917, 25 short courses were held. Thirteen conferences with the home-economics teachers in the State were held for the purpose of outlining conservation programs to be presented in schools. A series of lecture demonstrations were given at high schools and before other organizations.

Urban work was organized in St. Paul, Minneapolis, and Duluth. The extension agents cooperated with existing organizations and educational agencies in forwarding food-conservation work. Suggestions for adequate feeding, under the rules for conservation, were translated into various languages and explained to groups of foreign women by interpreters in order to reach promptly the large foreign elements in the populations of Minnesota cities.

Boys' and girls' club work.—The work was under the direct supervision of a State leader, with 3 assistant club leaders employed permanently, and with an assistant club leader, a district club leader, and 10 county club leaders employed on emergency funds. The instruction in boys' and girls' club work had the cooperation of the State department of education, county superintendents, normal schools, farm bureaus, and other farmers' organizations in the State. Some of the above agencies employed special people in agriculture and home economics, who cooperated in the club work. The work was assisted by 1,195 voluntary leaders, 98 per cent of whom were teachers and school supervisors living in the community where they did club work during the summer vacation. During the year the club leaders conducted 196 canning demonstrations, with a total attendance of 7,775 club members, women, and men; 56 field demonstrations; 96 club fairs and festivals; and 93 local, county, and State exhibits. In car-

rying on the work, 156,710 copies of follow-up instruction prepared by the State office were distributed; 1,762 club groups with a total enrollment of 14,882 members were engaged in the work; 62 per cent of the members had done work the previous year; 6,719 members reported products valued at \$129,166.70, produced at a total cost of \$48,886.70.

The following table gives some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plats or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	172	435	435 acres.....	13,552 bushels.	\$23,089.00	\$7,395.00
Potato.....	116	504	95 acres.....	17,728 bushels.	27,096.00	6,080.00
Home garden.....	510	1,325	2,650 square rods.	.....	16,112.00	7,165.00
Pork and crop.....	84	402	402 pigs.....	67,190 pounds.	12,094.70	4,568.70
Calf.....	6	42	42 calves.....	.....	1,300.00	713.00
Canning.....	510	2,326	4,652 square rods.	108,231 quarts.	39,200.00	16,800.00
Bread.....	340	1,685	.....	102,750 loaves.	10,275.00	6,165.00
Total.....	1,738	6,719	.....	.....	129,166.70	48,886.70

Total enrollment, 14,592.

Farm-management demonstrations.—Work was conducted in 12 counties. A great deal of attention was devoted to teaching farmers how to figure the cost of production of various farm products. Due to the present emergency, the demonstrator paid special attention in finding out the practicability of tractors for farmers' use. Data were collected to determine the cost of work done by tractors as compared with work horses. Assistance was also given county agent organization work. Five hundred and ninety-seven farmers began studying their business through simple farm accounts. Farm-analysis records were taken on 151 farms; these and 60 others taken the previous year were summarized and returned personally to the farmers.

Extension schools.—Twenty-five extension schools of five days each were held during the three winter months, and were attended by a total of 3,577 men and 2,674 women. Instruction was given by two specialists in farm crops and animal husbandry, and a separate section on home economics, including health, was held in an adjoining room. A recent act of the legislature prohibits the charge of any membership fee for defraying local expenses.

Demonstration farms.—In 22 of the 86 counties of the State the extension division has located demonstration farms, which were operated by the owner under a five-year agreement. These farms are operated to demonstrate the best methods of diversified farming with

reference to the chief agricultural interests of the community. There has been a notable increase in the amount of live stock on these farms. The dairy cattle on these farms are tested, careful milk records are kept, and the unprofitable cows have been sold. The seed for these farms is all tested at the college, and the neighbors are also taking advantage of this service. The owners of the demonstration farms keep records of receipts and expenditures, which, with the labor slips, are sent to the extension division, where the results are summarized and they are then returned.

Dairying.—Supervision was given 27 active cow-testing associations, involving 725 herds with 11,069 cows. Nine new cow-testing associations were organized, and 772 cows, or about 7 per cent, were disposed of as a result of cow-testing association work. Assistance was given in the erection of 67 silos. Supervision was given 3 bull associations of 24 blocks, involving 117 herds with 1,265 cows. Assistance was given in the selection and purchase of 99 pure-bred bulls, 521 pure-bred cows, and 422 grade cattle. This project was conducted in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture.

Horticulture.—On account of the war, a seed-potato clearing house was organized for the spring planting. Most of the specialist's time during the spring was given to the organization of "liberty gardens" with both village and farm people and with boys' and girls' garden work.

OTHER EXTENSION WORK.

Farmers' clubs.—Farmers' institutes, which are in charge of the extension director, were largely conducted through local farmers' clubs, of which there are now 461 in the State. These clubs were devoted to social as well as agricultural improvement.

Marketing.—This project was started in October, 1917, and was in cooperation with the Bureau of Markets, United States Department of Agriculture. The agent in charge was also engaged in marketing investigations. The principal effort was to install uniform systems of accounting. One hundred and twenty demonstrations of the Bureau of Markets accounting system were given to grain dealers, elevator men, and other men in agricultural business, 59 of whom gave assurance of adopting the system. A bookkeeping system for wool marketing was devised and has been used by a wool-buying organization.

SURVEY.

Although there was no increase in the number of county agents, the year's achievement in increased food production in the counties organized was most satisfactory, and the agents showed their value

by locating and distributing seed and labor and by organizing various local agricultural associations, as well as conducting campaigns for increased production. The hearty cooperation of the school system of the State, as well as the farm bureaus in the support of boys' and girls' club work, has resulted in increased enrollment and larger achievement through the inspiration of a large number of volunteer club leaders. The demonstration farms operated under contract are becoming centers of influence for better agricultural methods in their communities, and are determining the relative value of this method of extension work. The extension service has been recognized through its director as the agency for carrying out Minnesota's agricultural program during the war.

MISSOURI.

Division of Agricultural Extension, College of Agriculture, University of Missouri, Columbia.

A. J. MEYER, Director.

Organization and administration.—The general organization and administrative policy of the extension work was the same as in the previous year. The title of the secretary of extension was changed to director. There were numerous changes in the personnel of the staff and many new additions, owing to the war and a general acceleration of some activities to meet the war needs. The extension service is organizing all of its activities on a project basis in an effort to carry out a systematic program of demonstration work rather than devoting its attention chiefly to answering calls for assistance, as was necessary in its earlier work. Increasingly, both specialists and county agents are coming to appreciate that the various organized activities conducted by them are not ends in themselves but are merely means through which regular demonstration projects may be introduced.

Publications.—During the year 33 circulars were published, with a total of 314 pages and a total edition of 520,500 copies; 5 posters, with a total edition of 45,500 copies; and 17 emergency leaflets, with a total of 39 pages and in editions of about 6,000 copies each. The extension service, in cooperation with the college of agriculture and experiment station, maintains two weekly press services—the Farm News Service, which goes to about 800 Missouri newspapers, and the Agricultural Copy Service, which is sent to about 600 farm papers throughout the United States. These services have proved a valuable supplement to the regular publications in conducting various campaigns for increased production. The combined circulation of papers in Missouri which are known to be using material sent out through these services is 1,655,432.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal-----	\$52, 229. 32
Smith-Lever, State-----	42, 229. 32
United States Department of Agriculture, farmers' co- operative demonstration work-----	9, 626. 16
College-----	1, 012. 98
State appropriations-----	8, 690. 30
County-----	10, 056. 02
Total-----	123, 844. 10

Smith-Lever funds were used in the support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, farm-management demonstrations, extension schools, demonstration schools at fairs, rural organization, poultry, dairying, hog-cholera control, horticulture, soils and field crops, rural engineering, animal husbandry, and entomology. Funds from the United States Department of Agriculture were used in support of county-agent work.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents June 30, 1916, 14; June 30, 1917, 15. The work was supervised by the county-agent leader. The farm-bureau plan of organization was adopted and introduced in the State during the year, and a school of instruction was held in order to acquaint the men going out to organize farm bureaus with definite plans for organization, and in order that they might use a uniform plan throughout the State.

As a result of the regular activities of the agents, 1,049 farmers selected seed corn in the fall for 12,720 acres, and 5,954 farmers used other methods of corn growing recommended by agents on 27,413 acres. A special effort was made to encourage the raising of more legumes for feeding and soil improvement, and resulted in 129 farmers sowing 972 acres of alfalfa, 283 farmers raising 3,985 acres of soy beans, and 258 farmers raising 2,561 acres of cowpeas. Three hundred and thirty-seven orchards, involving 81,139 trees, were cared for according to recommendations of agents. Considerable attention was given to live-stock improvement and the control of live-stock diseases. Seventy-five registered bulls and 245 registered cows were secured and 216 registered sires transferred. Five live-stock breeders' associations and three cow-testing associations were organized, and 1,630 cows were put under test. The agents helped to bring about the testing of 648 animals for tuberculosis, the treating of

6,874 animals for blackleg, and the vaccination of more than 4,000 hogs by veterinarians and farmers. In order to encourage the use of lime for correcting soil acidity, the soil on 642 farms was tested and more than 4,000 tons of lime or limestone were used. Two hundred and thirty-seven boys' and girls' clubs, with a membership of 4,238, were organized and supervised by the agents. During the year 897 definite demonstrations, involving 14,913 acres and more than 10,000 live stock, were arranged for and supervised.

In addition to the regular work, the agents conducted special campaigns to increase crop and live-stock production. The State-wide campaigns for increasing the acreage of wheat and for locating and selecting seed corn were carefully conducted and especially successful. Two thousand one hundred and ninety bushels of seed corn and 61,475 bushels of seed wheat were secured or located. The acreage of corn was increased 8,545 acres and the production approximately 267,000 bushels. The acreage of winter wheat was increased by 27,600 acres. The bean acreage was increased 1,344 acres and the production 10,271 bushels. It is estimated that the campaigns for increased live-stock production resulted in 2,000 additional sows being bred and 6,600 additional sheep being placed on farms. One hundred and twenty-two canning demonstrations were arranged for adult women, and resulted in 160,820 additional quarts of vegetables and fruit being canned. During the year the agents made 5,061 farm visits, received 17,208 calls at their offices for information, and took part in 2,635 meetings attended by 127,733 persons.

Home economics.—Four State-wide specialists taught in extension schools and furnished programs and study material for 213 homemakers' clubs in the State, with a membership of 5,556 rural women; 85 of these clubs were organized in 1917. During the year 85 extension schools of 3 to 5 days were conducted with an attendance of 6,694 women. At these schools visits were made to farm homes equipped with conveniences and labor-saving appliances suited to the needs of the family, so as to give housekeepers an opportunity to become familiar with these appliances with the hope that they would install them in their own homes. During the summer and fall of 1917 eighteen emergency demonstration agents conducted a food-conservation campaign and gave 401 canning demonstrations in 96 counties, with an attendance of 22,567; 1,602 women reported 397,588 quarts of fruits and vegetables canned and 34,278 pounds of food dried and stored according to directions recommended by the demonstrators, the total value being estimated at \$130,000. When the emergency appropriation became available a State leader for home-demonstration work was appointed, and three assistant State leaders were employed to assist in county organization.

Boys' and girls' club work.—One thousand one hundred and thirty-five groups were organized with a total enrollment of 15,759 members, who reported products valued at \$63,482.76 at a cost of \$21,912.74. The club work was conducted by three paid cooperative club leaders on full time and one cooperative club leader employed on part time. There were also 569 unpaid, volunteer leaders. The club leaders conducted during the year 68 canning demonstrations, with a total attendance of 4,975 club members, women and men, 258 field demonstrations, and 77 club exhibits. The canning-club project was one of especial achievement, 27,426 quarts of fruits, 23,217 quarts of vegetables, and 3,332 glasses of jelly having been put up for home use by 636 boys and girls. The value of these canned products was reported as \$12,660. There was increasingly close cooperation with the public-school system of the State, and the State superintendent of public instruction officially accepted boys' and girls' club work, when properly supervised and satisfactorily completed, as meeting the agricultural requirements of the schools.

The following table gives some of the more important items regarding the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....		391	391 acres.....	18,762 bushels.	\$23,452.00	\$5,306.00
Home garden.....	55	390	12,480 square rods.	.....	5,328.00	1,293.00
Poultry.....	365	403	.....	10,134 chicks..	5,533.00	1,806.43
Pork and crop.....	3	149	304 pigs.....	54,858 pounds.	9,325.85	5,485.80
Canning.....	46	636	.....	50,643 quarts, 3,332 glasses jelly.	12,660.00	5,064.30
Bread.....	67	39	.....	519 loaves.....	51.80	25.90
Garment making.....	599	2,880	.....	18,972 garments.	7,132.10	2,931.31
Total.....	1,135	4,888	.....	.....	63,482.76	21,912.74

Total enrollment, 15,759.

Farm-management demonstrations.—Farm-management work was started in the State during the year. Eleven county agents took part in the work. The farm-management demonstrator devoted some time to getting out a farmers' account book. One hundred and thirty-three farmers began studying their business by means of simple farm accounts. Due to the war emergency, the demonstrator acted as State labor specialist during the summer and fall.

Extension schools.—Thirty-one extension schools were held in 23 counties, schools being held for the first time in 10 of these counties. The total enrollment was 4,773, and the average daily attendance was

51. The chief factor in making a school a success was good local organization, either temporary or permanent. Where schools were managed by a poor community organization they were poorly attended and interest was lacking. The extension schools occupy five days, and the local expenses were borne by the community, it being required that at least 50 persons sign the application for an extension school, agree to attend the school, and pay a membership fee of \$1. Courses in either animal husbandry or soils and crops were required at each school held for the first time, and courses in other agricultural subjects could be selected by the community.

Demonstration schools at fairs.—Educational exhibits were made at five county fairs and the State fair. The exhibits were accompanied by extension workers, who explained them to visitors and held conferences with those interested in particular problems. A series of boys' and girls' club contests were conducted at these fairs. Club members were instructed for three days in stock judging, corn judging, canning, and similar club work, and teams were then grouped for competitive work, prizes being offered by the fairs.

Rural organization.—Work under this project was confined to six counties. The immediate objective was to establish in the various communities well-organized groups of people pledged to a definite systematic and continuous program of agricultural betterment and community development. This program was one of action, including a range of demonstrations suited to the needs and desires of the different communities and the development and recognition of community leaders. As an incidental result of this work five of these counties have employed county agents.

Poultry husbandry.—This project was started late in the year and consisted of demonstration flocks and poultry records. In locating demonstration flocks, one or two farmers were selected in counties especially favorable for poultry development. The owner agreed to follow the plans of management recommended and to keep accurate accounts. The extension specialist is to visit the flock at least four times a year and hold a public demonstration for the poultry keepers of the community at each visit. Five such demonstration flocks were established in 4 counties; 32 poultry men were furnished records upon which they agreed to keep costs and profits of their flocks for one year under their own systems of management; 16 demonstrations and 4 exhibits were held during the year.

Dairying.—Sixty dairy farmers cooperated in keeping dairy herd records on blanks furnished; 15 of them completed records for a year. Twelve dairy demonstration farms were in operation at the close of the year and 60 other farms were awaiting an opportunity to enter the work. These farms serve as a continuous object lesson

of the value of improved dairy methods and management. Pure-bred dairy bulls were loaned by the college to two community breeding associations, whose members agreed to raise all heifer calves and to keep records of their production for at least one full year. One member reported a net income of \$87.77 per cow from 3 half-breed Ayrshires as against a return of \$52.99 per cow from 5 native cows of his herd for the same period. Five dairy improvement associations, 5 dairy breeders' associations, and 3 milk-producers' associations were given assistance. There were 4 cow-testing associations in the State, 3 of which were organized during the year. One (the Jackson County association) has been in operation for three years, and as a result of its work, 28 cows were sold as unprofitable the first year, 30 the second, and 50 the third year. The average of 131 cows under test 1916-17 showed an increase over 1914-15 of 1,606 pounds of milk and 80.7 pounds of butter fat valued at \$49.66 produced at an increased feed cost of \$3.76, or \$45.90 profit over feed cost and an increase of 63 cents in the amount of return for every dollar expended. A comparison of the records of the best 10 cows and of the poorest 10 cows showed a return of \$3.39 for every dollar spent for feed for the best cows as against \$1.46 in the case of the poorest cows. A summary of the results of this cow-testing work was published in Extension Circular No. 43. Assistance was given in the purchase of 50 pure-bred bulls and 63 heifers. The specialist is secretary-treasurer of the State dairy association, with which 18 dairy organizations in the State have affiliated.

Hog-cholera eradication.—The work under this project is illustrated by the activities in Green County. In February, 1917, a serious outbreak of hog disease diagnosed as cholera was reported by the county agent. The disease was spreading rapidly and some farmers had lost their entire herds. All farmers within and around the infected areas were urged to vaccinate with serum and virus all hogs that were not showing marked clinical evidences of hog cholera. Proper methods of cleaning and disinfecting pens were demonstrated. The hearty cooperation of the farmers made it possible to surround the infected areas with a zone of immune hogs, which served as an effective barrier to the spread of the infection. Similar work was done in other counties. Later work among farmers indicated that they were in the main thoroughly conversant with the value of vaccination, and further demonstrations were discontinued. At the extension schools special attention was given to hog cholera, but not to the exclusion of tuberculosis of cattle and hogs, blackleg in calves, and abortion.

Horticulture.—Six new orchard-management projects were started in 1917 to run five years. The work will cover pruning, spraying, cultivating, fertilizing, grading, and packing. Pruning demonstra-

tions were given in a good many orchards. In 14 orchards there are spraying demonstrations throughout the season following a regular commercial schedule of spraying. As the result of demonstration spraying in a neglected family apple orchard of 8 acres, the owner netted \$413.55 the first year. An orchard of 2,000 apple trees, which had never been sprayed or been productive up to its eighteenth year, in 1914, has been sprayed each year since, and in 1917 produced more than \$15,000 worth of fruit. Considerable work in all phases of grape culture was done in several sections where there is a total of more than 700 acres planted.

Soils and farm crops.—Surveys of soil acidity were made with the county agents in 8 counties, and 89 cooperators were secured in demonstrations of the use of ground limestone. Thirty demonstration tests of corn varieties and 41 of soy beans were made in cooperation with county agents. Loans of pure seed of corn and soy beans were made to 69 farmers in order to make available locally pure seed of improved varieties through these cooperators. Over 200 farmers entered the 5-acre corn-growing contest, half of whom finished the season and made reports. After war was declared several special State-wide campaigns were conducted. In the latter part of June 500 farmers in 29 of the best wheat counties were visited by the specialists or county agents. About 20 per cent of the fields visited were certified for seed, providing approximately 500,000 bushels of certified seed. During September a wheat campaign was conducted, involving 338 meetings with an attendance of 23,056, an average of $4\frac{3}{4}$ meetings and 329 in attendance per county. As a result, the average increase of wheat planted by those in attendance was estimated at 34.8 per cent over a normal year. Ninety per cent enlarged their wheat acreage, and 85 per cent reported better seed-bed preparation. During October and early November, 1917, a campaign for the selection and storage of seed corn was conducted through 136 meetings and 77 demonstrations, with an attendance of 10,606. Reports showed 25 per cent more of the farmers in attendance making field selection of seed corn, and a probable increase of 15 per cent in the number who would test their seed.

Rural engineering.—Blue-print plans of 55 farm buildings are available for distribution, and during the year 1,182 sets of plans were sent out. Four drainage demonstrations and 12 demonstrations of terracing to prevent soil erosion were held, and 6 extension schools were attended.

Animal husbandry.—More attention was given to the solution of definite problems and giving concrete assistance to communities and individuals as cooperators conducting demonstrations of community interest and benefit. An effort was made to secure cooperators from the membership of 33 extension schools attended. Seventy-seven

cooperators carried on demonstrations in seven communities, involving rape for hogs, self-feeders for hogs, hogging corn, soy beans, and rape, and silo building. In an effort to demonstrate the possibilities of community live-stock improvement 17 pure-bred bulls and 9 pure-bred cows were introduced in one county. No new live-stock associations were formed, but considerable work was done with the 8 associations existing. One of these county associations formed last year sold over \$12,000 worth of live stock this year, mostly in car lots. During December, 1917, a campaign was conducted for increased pork production, and 135 meetings were held with an attendance of 4,416 farmers. Most of these meetings were conducted by practical farmers and stockmen, and it is believed produced definite results. Live-stock exhibits were made at nine street fairs and colt shows, at which the stock was judged and the value of better sires was stressed.

Entomology.—The chief work under this project was in demonstrating methods of controlling the San José scale and the Hessian fly. Spraying-demonstration work for San José scale was continued in the spring of 1917 in 22 counties. In every demonstration orchard the work was a complete success. The spraying-demonstration work was cooperative in every case. The owner or manager of the orchard furnished the spraying chemicals, labor, spraying outfit, and equipment; while the agricultural-extension service furnished the spraying specialist. Summer spraying demonstrations were held in 24 counties, largely in home orchards. At harvesting time meetings were held in nearly all the demonstration orchards to show the farmers and fruit growers of each community the value of thorough and timely spraying on the production of marketable fruit. In reply to a questionnaire sent 100 farmers who cooperated in spraying, 70 replied, showing that from 17,359 trees, sprayed at a cost of \$4,443.95, the fruit was valued at \$43,647, while from 3,407 unsprayed trees the fruit was worth but \$92.25. The Hessian-fly work was presented to groups of farmers in 8 counties, 1 to 10 meetings being held in each county, the meeting being held, so far as possible, in infested wheat fields. Seven hundred and fifty-three cooperators were secured whose wheat crops showed very little damage due to the fly. No better demonstration could be made of the effectiveness of the fly-free dates than was shown in the southeastern counties. The wheat sown after the dates recommended was green and fresh, while that sown on a similar seed bed, but too early, was a poor stand, yellow in color, thin on the ground, and heavily infested by the fly. During the year 157 farm demonstrations were held, 1,448 cooperators were secured, and 16,566 persons were reached in 112 counties.

SURVEY.

The further organization of all extension activities on a project basis was justified by a larger achievement in tangible results, and by an increased coordination of the work of specialists and county agents. The introduction of the farm-bureau system of county organization with the general support of the extension staff of a uniform plan should also increase results of extension instruction. The encouragement of local farmers' organizations is preparing the way for the further development of farm bureaus. Campaigns for increased crop production were notably successful in the 15 counties with agents. Home-makers' clubs and the use of visits to neighboring homes as laboratory exercises in connection with extension schools have been demonstrated as valuable means for extension work in home economics. Satisfactory cooperation with the public-school system and the generous support of many volunteer leaders in securing commendable results in boys' and girls' club work, and the use of contests and schools of instruction at local fairs is adding zest to club work. The concrete results secured from cow-testing associations furnish an admirable example of extension work so organized as to furnish a measure of its efficiency. The necessity for educational work carried on by extension methods in campaigns for the control of animal diseases has been demonstrated in the work against hog cholera. The demonstration work in the control of insect pests is well conceived and is so managed as to insure that it has really demonstrated the methods advocated as shown by actual use by neighboring farmers. Missouri is one of several States which have found a well-organized publicity service of peculiar value under war conditions for disseminating desirable information through the press. Distinct progress in the organization and methods of extension work presage the increased usefulness of the extension division.

MONTANA.

Division of Extension Service, Montana State College, Bozeman.

F. S. COOLEY, *Director*.

Organization and administration.—The organization of the extension service was continued during the year in accordance with the original plan. In its relationship with the University of Montana, of which the State College of Agriculture and Mechanic Arts at Bozeman is a branch, the extension service forms the third principal division, and is coordinate with the college of agriculture and the experiment station. The president of the college, the director of the experiment station, and the director of extension service form the

executive council of the institution, and each reports directly to the chancellor of the university.

Relationships with governmental departments of the State were, as heretofore, strictly voluntary. There was no mandatory coordination of work. There was, however, a need growing out of the national crisis of an unusual amount of mutual counsel and assistance. The State commissioner of agriculture, State veterinarian, State board of health, and State dairy commissioner have come to work more closely with the extension service.

Publications.—Seven extension publications were issued during the year.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$15, 408. 35
Smith-Lever, State.....	5, 408. 35
United States Department of Agriculture, farmers' co-operative demonstration work.....	10, 643. 01
Bureau of Biological Survey.....	1, 300. 00
Bureau of Markets.....	1, 000. 00
Bureau of Animal Husbandry.....	2, 568. 28
College.....	44, 425. 00
Total.....	80, 752. 99

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, farm-management demonstrations, and live-stock improvement. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, home economics, boys' and girls' club work, farm-management demonstrations, dairying, live-stock improvement, marketing, and control of mammal pests.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—County agents June 30, 1916, 7; June 30, 1917, 12. The work was supervised by a county-agent leader with 1 assistant.

Among the results of the work during 1917 are the following: Three hundred and fifty farmers followed suggestions of agents in selecting seed corn in the fall, resulting in 4,080 additional acres of corn being planted with fall-selected seed; 1,145 farmers followed suggestion of agents in growing wheat, resulting in 226,640 acres being raised according to methods recommended; 268 farmers treated

their seed potatoes for the control of potato diseases, resulting in 1,182 additional acres being raised from treated seed. In order to bring about increased live-stock production and live-stock improvement, two cow-testing associations and six live-stock breeders' associations were organized. Through these associations, 81 registered bulls, 71 registered cows, and 208 registered rams were secured. Nine thousand calves were vaccinated for blackleg by agents or at their suggestions. As far as possible, the agents had the farmers present do some of the vaccinating, and then advocated the cooperative purchase of an outfit if one man did not feel the need of buying an outfit for himself. Seven hundred and five farmers were induced by agents to keep farm accounts. More than \$500,000 worth of business was done by the cooperative buying and selling associations and farmers exchanges organized with the assistance of agents, resulting in a \$25,600 saving to farmers. The agents conducted 745 demonstrations, involving nearly 1,000,000 acres of crops and 2,072 head of live stock. This includes 895,000 acres involving gopher-control demonstrations. Gopher control was successfully demonstrated in 12 counties. More than 10,000 farmers took part in this campaign, in which more than 4,500 ounces of strychnine were used, purchased at a saving of 75 cents per ounce. It is estimated that more than 10,000,000 gophers were poisoned. Seventy-five tons of poisoned bran were used in grasshopper-control demonstrations.

When war was declared the Montana Agricultural College placed faculty members in counties not having regular agents to serve as emergency demonstration agents to help stimulate food production. These agents and the regular agents did effective work in helping to secure seed grain and to increase crop and live-stock production to meet the war needs, resulting in 1,720 farmers being assisted in securing or locating 172,790 bushels of seed wheat, 33,130 bushels of seed oats, 7,664 bushels of seed potatoes, and 8,272 bushels of seed beans. Through the campaigns for increased crop production the wheat acreage in the State was increased by 172,790 acres, increasing the production more than 750,000 bushels; the oat acreage was increased by 22,802 acres, increasing the production 153,200 bushels; the corn acreage was increased by 13,610 acres, increasing the production 129,650 bushels; the barley acreage was increased by 6,880 acres, increasing production by 70,660 bushels; and the potato acreage was increased by 4,585 acres, increasing the production nearly 500,000 bushels. The agents also assisted in securing or placing 5,372 farm laborers. Through campaigns for increased live-stock production 5,208 additional sheep were raised and 1,246 additional cows were bred. The agents assisted in locating 1,100 horses for the War Department. Thirty-seven farm tractors were rented or loaned through

the efforts of agents, resulting in 33,200 additional acres being plowed with tractors. One thousand two hundred and fourteen individual farmers were assisted in securing credit for buying farm machinery, seed, feed, etc., and the agents gave assistance in the organization of 65 farm-loan associations through which a large number of additional farmers obtained farm credits. Two hundred and eighty-three canning demonstrations were held for women, aside from club work, resulting in 57,620 additional quarts of fruit and vegetables being canned; 2,883 persons received assistance in home gardening, and 5,860 farmers received information in regard to storing fruit and vegetables.

The agents made 5,821 visits to farms, gave information to 8,607 callers at their offices, and took part in 863 meetings, attended by nearly 100,000 persons.

Home economics.—Home-economics extension was conducted through movable schools, single demonstrations, and home visits. Twenty movable schools were held, with an attendance of 4,100. Special attention was given to food, nutrition, health, child welfare, and home efficiency. As a follow-up measure, personal letters were written to all women who registered in the winter extension schools. Seventy-two meetings were held, with an attendance of 4,804. Fifty women's clubs were supplied with outlines for food study. As a result of the child-welfare work, 27 communities received assistance during the community "baby week."

When the war emergency arose the preservation of food became the immediate problem. Twenty flying squadrons were organized and 387 farmers' defense meetings were held, with an attendance of 43,000. With each squadron was a well-trained home-economics woman who gave a talk on food conservation and a demonstration in the canning of vegetables. As a result, 61 communities formed mothers' and daughters' canning clubs with a membership of 280. It was estimated, as a result of the work of these flying squadrons, that there were preserved 66,972 quarts of fruits and vegetables, 25,719 glasses of jelly, and 3,083 pounds of dried material, valued at \$25,-343.24. In the spring a home-demonstration agent was placed in Missoula County for two months. After the emergency food bill was passed home-demonstration agents were placed in eight counties, and in order effectively to supervise this work an assistant State leader was added to the staff.

Urban home-demonstration agents were appointed for Great Falls and Butte, where organizations have assisted the agents in the work. In Great Falls a committee, composed of members from every city club, has volunteered to place food exhibits in the store windows. The training of volunteer leaders insures the permanency of the work.

Boys' and girls' club work.—The work was conducted by two leaders paid cooperatively from State and Government funds. The State department of education, the county superintendents of schools, and the State normal school also assisted in the work. The progress made during the year is shown by the facts that the number of projects increased from 3 in 1916 to 6 in 1917, the number of club groups from 129 to 290, and the total enrollment from 1,542 to 5,418. The most important achievement was the potato-club work, in which the reports of 629 of the 1,195 boys and girls enrolled showed an average yield of 109.8 bushels per acre. The club leaders in carrying on the work conducted 50 canning demonstrations, attended by 2,905 club members, men and women; 45 field demonstrations; 19 club fairs and festivals; and 37 club exhibits. They visited 170 club plats, and sent out 29,000 follow-up instructions.

The following table shows some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	8	54	27 acres.....	1,064.2 bushels.	\$1,596.30	\$300.35
Potato.....	100	629	158 acres.....	17,348.75 bushels.	26,023.13	3,366.71
Home garden.....	47	617	115.35 acres.....	.....	54,657.62	21,429.07
Pork and crop.....	1	13	13 pigs.....	1,781 pounds.	318.45	220.91
Mother-daughter canning.....	47	114	.....	8,272 quarts, 877 jars jelly.	3,198.05	1,659.30
Bread.....	87	412	.....	10,352 loaves.....	1,352.80	856.32
Total.....	290	1,839	.....	.....	\$7,346.35	27,832.66

Total club enrollment, 5,418.

Farm-management demonstrations.—During the year work was carried on in 11 counties. A great deal of time was spent teaching farmers how to study their farms through simple farm accounts; 705 farmers started account books during the year. Farm-analysis records were taken on 35 farms. These and 58 other records taken the preceding year were summarized, returned, and personally discussed with the farmers. As a result of farm-management demonstration work, 70 men decided to change the management of their business in order to increase their labor income.

OTHER EXTENSION WORK.

Dairying.—This project was continued in cooperation with the Dairy Division of the United States Department of Agriculture. Supervision was given two active cow-testing associations, involving

43 herds of 790 cows. One new association and a special association were organized. One bull association block in which there was 31 cows was formed. A State dairymen's association and one local dairy association were organized. A silo demonstration was given at a county fair. The county agents have been assisted in meeting local dairy problems.

Live-stock improvement.—One of the most valuable features of the work of the live-stock specialist was in the organization of boys' pig clubs. The specialist instructed the county agents in vaccination for the prevention of blackleg, and assisted them at live-stock meetings, at which better methods of feeding and sheltering stock have been stressed. The work was carried on in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture.

Cooperative extension work with the United States Department of Agriculture.—The Biological Survey cooperated in the control of mammal pests, particularly ground squirrels. A new cooperative project was arranged. The Bureau of Entomology lent assistance in grasshopper control and furnished an instructor in beekeeping for three weeks. The Bureau of Animal Industry furnished a man for instruction with the wool-demonstration car containing a wool exhibit prepared by that bureau, and furnished the State a cheese instructor for part time.

SURVEY.

Increased coordination of all the agricultural forces of the State and effective team work have resulted from common effort in meeting the problems arising with the war. The assistance of the faculty of the college in acting as emergency demonstration agents in the counties without county agents for the stimulation of larger food production was particularly helpful. The work of the county agents in the organization of the gopher-poisoning campaign, in securing horses for the War Department, and in organizing farm-loan associations, as well as in encouraging increased crop production, showed their grasp of local problems and the value of their leadership in time of war. A beginning was made in the employment of county home-demonstration agents, whose services should be peculiarly valuable in a State of great distances where it is difficult for State extension workers to secure personal contact with the many isolated farm homes. Boys' and girls' club work more than doubled in size and scope and the record of the potato clubs shows their very considerable economic achievement and their importance as a factor in increased food production.

NEBRASKA.

Division of Agricultural Extension Service, College of Agriculture,
University of Nebraska, Lincoln.

C. W. PUGSLEY, *Director*.

Organization and administration.—Little change was made in the extension organization and in the duties and relationships of the principal offices of the extension service. Practically no change occurred in the relationship to other parts of the university or to other State institutions. The director of extension was appointed a member of the State council of defense and secured much assistance from that body in the organization of counties for permanent extension work. As a means of increasing the efficiency of extension workers by giving them a better understanding of what each was attempting to accomplish, monthly conferences were held.

Publications.—During the year 19 regular extension publications were used, with a total of 164 pages and a total edition of 131,000 copies. Of this number 8 were bulletins; 2, emergency bulletins; 6, circulars of instruction for boys' and girls' club work; and 3 were leaflets on the organization of extension work.

At the beginning of the war an information service was established, known as "War Emergency Bulletins." Twenty-five of these bulletins were issued, dealing with the production and conservation of foods and food crops. The agricultural editor also edited the Extension News Service, which went to about 700 papers circulating in Nebraska and to about 1,300 individuals.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal -----	\$29, 645. 80
Smith-Lever, State-----	19, 645. 80
United States Department of Agriculture, farmers' cooperative demonstration work-----	14, 368. 91
Bureau of Animal Industry-----	3, 111. 97
Bureau of Markets-----	400. 00
College -----	7, 950. 00
State appropriations-----	7, 144. 09
County-----	15, 000. 00
Other sources within the State-----	61, 350. 00
Total-----	158, 616. 57

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, farm-management demonstrations, extension schools, dairying, agricultural engineering, agronomy, animal husbandry, and horticulture. Funds from the United States Department of Agri-

culture were used in support of the following projects: County-agent work, home economics, boys' and girls' club work, farm-management demonstrations, dairying, animal husbandry, and marketing.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents June 30, 1916, 9; June 30, 1917, 8. The work in the State was supervised by a county-agent leader. Schools of instruction were held to familiarize the agents and organizers with the methods of organizing and using the farm-bureau type of organization. Seven counties reported a total membership of 1,938 persons in farm bureaus. Two counties employed assistant agents.

Among the outstanding results during 1917 are the following: Fifty-one thousand six hundred acres of corn were planted with tested seed and 1,828 farmers were induced to treat seed oats for smut, resulting in 39,580 acres being planted with treated seed; 3,838 acres of potatoes were planted with treated seed by 271 farmers. A special effort was made to control live-stock diseases; 16,144 animals were treated for blackleg, at the suggestion of the agents, who also assisted in vaccinating 16,011 hogs for cholera.

Special campaigns were conducted to increase crop and live-stock production to meet war conditions. Five thousand two hundred and fifty-three bushels of seed potatoes, 25,222 bushels of seed wheat, and 6,100 bushels of seed corn were secured for farmers. As a result of the campaign 4,350 additional acres of potatoes were planted and the production was increased more than 250,000 bushels; 128,800 additional acres of wheat, principally winter wheat, were sown; and the acreage in beans was increased 3,020 acres and the production 16,250 bushels. In order to help the farmers secure farm credit, assistance was given in organizing 11 farm-loan associations. Eight hundred and seventeen farm laborers were secured through the agents' offices for farmers. The farmers' exchanges and purchasing and marketing associations, organized with the assistance of the agents, did more than \$100,000 worth of business and saved the farmers \$7,800.

The agents arranged for and supervised 245 definite demonstrations, involving 144 acres of crops and nearly 15,000 live stock. In doing the work they made 4,160 farm visits, received 13,080 calls at their offices, and arranged for and took part in 518 meetings, attended by 20,080 persons.

Home economics.—The State-wide extension work was in charge of a leader and five assistants. The work included short courses, preliminary county-agent work, and farmers' institutes. Thirty-five short courses were held, with an average of 75 at each school. Ses-

sions of short courses and institutes were attended by 15,221. The short courses have been outlined to cover progressive work for a five-year period, each course including work with food, clothing, or household administration. To demonstrate the kind of work a county home-demonstration agent could do with rural women, one assistant spent three months in five counties, visiting regularly groups of women, who were later organized into clubs. The extension work with rural women's clubs particularly was successful and has paved the way for resident agents. Information regarding better-baby week was sent to 175 communities.

The outstanding feature of the summer's emergency work was food preservation. The campaign opened with training schools for members of the staff and for qualified students at the college of agriculture, at State normal schools, and at the Curtis School of Agriculture. These workers held 45 training schools at 33 places, with an attendance of 2,150. Each woman was pledged to teach the cold-pack method of canning in her own community, to keep records of attendance, and to secure reports of work done in her territory. One volunteer reached 998 women. Because of the can shortage, special attention was given to drying. A striking outgrowth of this campaign was the establishment of five community drying plants. Although it is estimated that more than 1,500 bushels of material were dried at these plants during the season, the idea took so well that none of the plants was large enough to handle the materials brought to it. These community drying plants attracted nation-wide attention and have been described in Farmers' Bulletin No. 916, United States Department of Agriculture.

General conservation work was presented by means of exhibits and demonstrations at State assemblies and conferences and State and county fairs. At the State fair 17,000 women were reached, and 7,000 at 7 county fairs. Work lasting from 2 to 5 days was given at 10 teachers' institutes, where conferences were held with teachers who wished to start the serving of hot lunches in rural schools. In the first Food Administration pledge card campaign between 50,000 and 60,000 women were enrolled by the extension service.

Two home-demonstration agents were at work in counties before emergency funds were available, and two others were employed later. A State leader and five assistants gave their attention to organization. As a temporary measure the State was districted with the intention of transferring the district agents to counties as soon as these could be organized to support the work. A school of instruction was held at the college for these agents. In one county (Custer) the interest of the women was sufficient to secure a home-demonstration agent before the county was ready for an agricultural agent.

City home-demonstration work was started in Lincoln in September, 1917. The urban home-demonstration agent in Lincoln not only gave demonstrations personally but she enlisted the volunteer help of city women who were trained in home economics and worked in cooperation with the educational agencies and the women's clubs. Food and clothing conservation was promoted by demonstrations and exhibits. A successful campaign for the conservation of fuel was planned by the urban home-demonstration agent in cooperation with the fuel administrators, physicians, engineers, and retail distributors of heating and cooking equipment. A school of instruction was arranged to train volunteers to carry the information to homes in all parts of the city.

Boys' and girls' club work.—The club work was conducted under seven subject-matter projects by six cooperative club leaders employed permanently on cooperative funds and one leader employed temporarily on cooperative funds. There were also 2,500 unpaid volunteer leaders who assisted in the work in their local communities. Through the efforts of the club leaders an enrollment of 11,366 boys and girls was secured, of whom 4,335 reported the production of \$75,365.66 worth of products at a cost of \$16,114.75. During the year the club leaders conducted 2,000 canning demonstrations, with a total attendance of 26,000 club members, women and men. Three hundred field demonstrations, 20 club fairs and festivals, and 50 club exhibits were also held.

The junior work gave attention to the stimulation of food production and the preservation of surplus products. One of the special campaigns was the raising of war gardens. Forty-six towns were induced to hire paid supervisors for this work. In these centers alone there was an enrollment of 6,000 boys and girls and 3,000 children who were under 10 years of age, who were growing gardens but who were not required to keep records. According to reports received the average production of a child's garden was worth about \$8. Special emphasis was given at these garden centers to the matter of canning and drying the surplus products. There were 23,255 quarts of fruit and 24,313 quarts of vegetables put up for home use by mother-daughter clubs and 9,635 quarts of fruits, vegetables, meats, and soups put up by other canning clubs. The fresh vegetables produced and the value of fruits, vegetables and meats canned resulted in an estimated net profit of \$50,485.91 to the State. Besides the above, large quantities of fruits and vegetables were dried for winter use.

The following table gives some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Club members reporting results.	Plats or animals managed.	Product.		
			Amount.	Estimated value.	Estimated cost.
Corn.....	100	63 acres.....	2,438 bushels..	\$2,730.00	\$1,283.00
Potato.....	60	20 acres.....	2,761 bushels..	2,803.00	1,126.00
Poultry.....	636	4,500 fowls....	3,243 chicks; 10,425 dozen eggs.	4,277.00	1,013.00
Pork and l crop.....	153	119 pigs.....	17,022 pounds..	4,097.00	2,687.00
Home canning.....	766	.....	9,633 quarts...	15,697.66	1,162.75
Mother-daughter canning.....	2,445	.....	47,568 quarts..	44,361.00	8,410.00
Garment making.....	175	.....	1,000 garments	1,400.00	409.00
Total.....	4,335	.....	.....	75,363.66	16,114.75

Total club enrollment, 11,366.

Farm-management demonstrations.—During the year eight counties conducted farm-management demonstration work. Special work was done in teaching farmers to study their business through simple farm accounts; 286 farmers were assisted by the county agents and farm-management demonstrators in starting accounts. Farm-analysis records were taken on 167 farms. These and 73 other records taken the previous year were summarized, returned, and personally discussed with the farmers. As a result of farm-management demonstration work, 33 farmers modified the management of their farms with the view of increasing their labor income.

Extension schools.—Twenty-two extension schools were held during the year, only eight of them being in places where schools had been previously held. The general plan of the schools was the same as in 1915-16.

Dairying.—Supervision was given four cow-testing associations, involving 52 herds of 810 cows. One new association was organized. Individual farmers were assisted in the selection and purchase of cattle, the construction of buildings and silos, the planning of rations, and in herd management, for the purpose of demonstration to their neighbors. Farmers were assisted in the purchase of 15 car-loads of cattle, worth \$27,225. This work was done in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture.

Agricultural engineering.—The work consisted in furnishing plans and advice to farmers and county agents for the construction of farm buildings and the installation of farm machinery; 16 weeks were spent in instruction at extension schools.

Agronomy.—Through a general survey of farm crop conditions, the specialist concludes that the chief problems needing extension effort are sand blowing, the care of pastures and meadows, and

alfalfa growing. The specialist assisted county agents in three county tours.

Animal husbandry.—In cooperation with the county agents, the specialist conducted 12 cattle-feeding demonstrations, 4 hog-feeding demonstrations, 4 hog-management demonstrations, 4 calf-management demonstrations, and 53 demonstrations in butchering and meat cutting. Instruction was given at 10 extension schools and 40 farmers' institutes. A total of 135 meetings, with 13,169 in attendance, were instructed. The work was done in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture.

Horticulture.—There were 55 orchard-pruning and orchard-management demonstrations and a few in grape pruning. In five of these orchards there was follow-up summer spraying on fruit to be exhibited at county fairs in the fall. Some fruit grading and packing work was done, also some cooperative work in home orchards with the county agents. In the gardening work 1,155 people were reached by means of meetings, conferences, farm visits, and demonstrations.

OTHER EXTENSION WORK.

Marketing.—This project was inaugurated during the year in cooperation with the Bureau of Markets, United States Department of Agriculture, and is too recent to show definite results. Ten weeks were spent in instruction at extension schools. Marketing problems were discussed with audiences aggregating 7,220 persons.

SURVEY.

The State council of defense, of which the director of extension was a member, gave material assistance in promoting the organization of counties for permanent extension work. Though the number of county agents showed no gain, those employed increased their efficiency through the better organization of farm bureaus, and made an enviable record in stimulating greater crop production. The organization of local farm-women's clubs resulted in creating a demand for county home-demonstration agents; and, in one case, the women of a county secured a home-demonstration agent before there was organized county-agent work. The successful operation of several community drying plants was one of Nebraska's contributions to the new methods of food conservation necessitated by the war. The encouragement of the towns to employ supervisors for war-garden clubs enlisted a small army of patriotic boys and girls, who would not otherwise have come under the influence of club work. As in other States, the noteworthy achievement of the junior exten-

sion work in food production and conservation was largely a result of the remarkable enlistment of volunteer leaders of local clubs. The Nebraska extension service has been particularly successful in furnishing information to meet the many agricultural problems incidental to war conditions, both through the publication of literature, and through its news service. The extension division has a clear grasp of its field and is effectively meeting its increased responsibility.

NEVADA.

Agricultural Extension Division, University of Nevada, Reno.

C. A. NORCROSS, *Director*.

Organization and administration.—The organization of the extension division and its relations with the State, the college, and the local institutes has remained unchanged. The legislature, in March, 1917, passed acts creating the southern Nevada agricultural board, and the northern Nevada agricultural board. Under these acts, provision was made for State appropriations for cooperative agricultural and home economics extension work in Clark and Elko Counties. A local board was appointed in each county, by the governor, to have charge of the work, subject to the approval of the extension director of all appointments, project work, and budgets. The board was organized in May, 1917, and county agents were assigned to the two counties. The extension staff, at the end of the year, consisted of the director, who also acted as county-agent leader; a State leader in home economics and club work; a State leader in dairy work; a field agent in animal diseases; two district club leaders; two district county agents, and a secretary.

Publications.—During the year 6 bulletins, totaling 84 pages and 24,500 copies; 5 leaflets, totaling 20 pages and 12,000 copies; 2 numbers of the Agricultural Extension News, totaling 15,000 copies; and 3 circulars, totaling 20,000 copies, were published.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal.....	\$11, 527. 06
Smith-Lever, State.....	1, 527. 06
United States Department of Agriculture, farmers' cooperative demonstration work.....	2, 027. 03
Bureau of Biological Survey.....	2, 200. 00
Bureau of Animal Industry.....	1, 500. 00
College.....	5, 890. 07
State appropriations.....	1, 821. 84
Total	26, 493. 06

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, control of animal diseases, dairying, and extension specialists. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, boys' and girls' club work, dairying, and control of mammal pests.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—County-agent work was not begun in the State until September, 1916. On June 30, 1917, two district agents were covering six counties. The work was supervised by the extension director, who acted as county-agent leader. Soon after the declaration of war, plans were made for the employing of more agents, and following the passage of the emergency food-production bill, six agents were appointed. The agriculturist on the Truckee-Carson project of the United States Reclamation Service also cooperated in the work.

Among the outstanding results in 1917 were the following: Three hundred and four acres of alfalfa and 100 acres of clover were sown at the suggestion of agents, and 500 acres of clover were plowed under for soil improvement. To encourage live-stock improvement one breeders' association was organized, 25 registered bulls were secured at the suggestions of agents, and 334 animals were treated for blackleg.

The agents encouraged farmers to increase their crop and live-stock production, and as a result 200 additional acres of beans were planted and the production increased 3,500 bushels, and more than 1,000 additional calves were raised. Twelve thousand bushels of seed wheat, and 330 laborers were secured for farmers through the agents' offices. Two hundred persons were assisted in home gardening.

In doing the work the agents made 1,405 visits to farmers and took part in 55 meetings, attended by 1,656 persons.

Home economics.—Prior to July 1, 1917, one home-economics specialist divided her time between meeting the needs of the farm women and in guiding the boys' and girls' club activities. It was the aim of the worker to discover how the burden of rural women in a sparsely settled State might be lightened by remodeling kitchens and providing labor-saving equipment. She taught the women farm home sanitation, the principles of good health, the proper care of infants and children, home care of the sick, food preparation, preservation, and conservation. During the year 23 lectures were given in different parts of the State, with an attendance of 1,548. Personal visits to homes numbered 778. Twenty-five demonstrations were

given in cooking, canning, and serving, with an attendance of 343. Two home-economics extension schools were conducted, with an attendance of 592. On war-emergency funds a State leader and three county home-demonstration agents were provided, and a new program of demonstration work was outlined. This program dealt with food conservation, canning and drying campaigns being carried on over the State. One county reported over 5,000 quarts of tomatoes canned by housewives for home use. The greater part of this product represented a saving of surplus.

Boys' and girls' club work.—The work was conducted under 10 subject-matter projects by four club leaders, employed cooperatively for entire time, and four leaders employed temporarily on cooperative funds. In addition, 21 volunteer leaders assisted in the work in their respective communities. One hundred and eighty-six clubs were organized with a total enrollment of 2,454 club members, who reported products valued at \$7,771.35 produced at a total cost of \$3,441.22. Seventy-five per cent of the club groups and 75 per cent of the club members enrolled were engaged in this work during the preceding year. The plan of club work in Nevada anticipates a close correlation with the rural-school system, which is being developed under a general understanding between the State superintendent of public instruction and the director of extension.

The following table gives some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Home garden	55	341	8,520 square rods.	.....	\$3, 410. 00	\$682. 00
Poultry	29	31	155 fowls	{ 775 chicks	1, 015. 25	930. 00
				{ 1,085 dozen eggs.		
Baby beef	7	11	11 animals	5,500 pounds ..	660. 00	165. 00
Pork and crop	18	20	23 animals	3,450 pounds ..	621. 00	296. 00
Sheep	7	24	36 lambs .....	.....	259. 20	230. 40
Goats	3	8	160 animals .....	.....	.....	.....
Home canning	6	50	.....	1,200 quarts, 25 glasses jelly.	279. 75	111. 75
Garment making	36	62	.....	464 pieces	398. 15	271. 35
Cooking	25	200	.....	15,168 pieces	1, 128. 00	754. 72
Total	186	747	.....	.....	7, 771. 35	3, 441. 22

Total club enrollment, 2,454.

Animal-disease control.—This project was conducted in cooperation with the State veterinary control service and was one of the most important features of the extension work. The means of con-

trol have been along the lines of education, demonstrations, and actual field operations, which have gradually overcome skepticism, ignorance, and prejudice. One hundred and two herds of 6,537 animals were vaccinated for anthrax; 27 animals in 3 herds were vaccinated for blackleg; 51 herds were treated for hemorrhagic septicemia, 3,947 cattle being vaccinated and 5 given serum treatment; 30 herds of 861 cattle were tested for tuberculosis; 2 herds of 111 animals were vaccinated for strangles; and 23 herds, including 58 hogs, were vaccinated for hog cholera. Cerebrospinal meningitis of horses, rabies, and glanders also received attention. One flock of 177 birds was treated for epitheliosis or "bighead," and 38 flocks of 3,870 birds were treated for fowl cholera. Five hundred and eighty-three were visited during the year, involving 16,166 miles of travel. Owing to the scattered population the work was necessarily chiefly with individuals in response to requests for help.

Dairying.—One cow-testing association, involving 30 herds of 623 cows, was organized. Assistance was given in the selection and purchase of 5 pure-bred bulls and 21 pure-bred cows, and in the erection of 3 barns, 2 milk houses, and 1 silo—the first in southern Nevada. One dairy association was organized. The monthly scoring of creamery butter was continued and 8 of the 9 creameries in the State participated. Two cheese-making demonstrations and 6 dairy demonstrations were given. The system of certification of high producing cows was continued, and dairymen have found that these certificates increase the selling value of their cows. Fifteen graduates for the four-month course for boys tested herds throughout the State. Three hundred and five farms were visited and 40 meetings were addressed with an attendance of 1,033 people. This work involved 11,667 miles of travel. This project is in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture.

Specialists.—The staff of the college of agriculture continued to give such assistance with special meetings and field work as their college duties permitted.

Other cooperation with the United States Department of Agriculture.—A cooperative understanding has been entered into with the Bureau of Plant Industry, whereby the work of the agriculturist of the Truckee-Carson reclamation project, comprising most of the farm area of Churchill County, is to be correlated with the general county-agent work. A cooperative understanding was entered into with the Forest Service of the United States Department of Agriculture whereby the National Forest supervisor and seven foresters are to cooperate in agricultural extension within their districts.

SURVEY.

The inauguration of county-agent work with State financial support and with a definite plan for its expansion as a war-emergency measure will make possible an organization of extension work which can more effectively reach the scattered population with its varied local problems. The extension specialist in home economics had studied the pressing needs of rural women in a sparsely settled State and was prepared to expand the work so as to give them more assistance in meeting their home problems arising from war conditions. Extension work in animal-disease control continued to be the outstanding State-wide project. With the assistance of county agents, this work should be even more successful in educating stockmen in the prevention of disease. The cooperative relations established with the United States Reclamation Service and the Forest Service for securing a correlation of the extension activities of their local employees, should enable these agencies to render a much more effective extension service to the sections concerned.

NEW HAMPSHIRE.

Division of Extension Work, New Hampshire College of Agriculture and Mechanic Arts, *Durham*.

J. C. KENDALL, *Director*.

Organization and administration.—There was no change in the general plan of organization from that of previous years. The director of the experiment station is also director of the division of extension work.

Publications.—Seventeen publications with a total of 99 pages and 487,000 copies, and one reprint of 42 pages and 5,000 copies, were issued during the year. The mailing list includes about 11,000 names.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$13,911.34
Smith-Lever, State	3,911.34
United States Department of Agriculture, farmers' cooperative demonstration work	8,943.31
Bureau of Animal Industry	400.00
College	1,778.96
State appropriations	300.00
County	9,300.00
Other sources within the State	16,004.74
Total	54,549.72

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, farm-manage-

ment demonstrations, dairying, orchard demonstrations, and vegetable gardening. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, home economics, farm-management demonstrations, and poultry husbandry.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents June 30, 1916, 8; June 30, 1917, 9. The work was supervised by the county-agent leader. Every county in the State has an active farm-bureau association, the total membership of farm bureaus being 3,151. During the year the State legislature removed the \$1,200 limit on the amount counties can appropriate for extension work and all counties made substantial appropriations for the next two years. Most of the counties in the State have been mapped by communities and the location of major lines of work indicated.

Among the outstanding results during the year were the following: One hundred and eighty-four farmers tested their seed corn for germination, resulting in an increase of 620 acres in the acreage planted with tested seed; 287 farmers treated their seed potatoes for the control of potato diseases; 203 acres of soy beans were raised by 130 farmers at suggestion of the agents; and 132 farmers followed methods recommended in pruning, spraying, and other care of fruit trees. Considerable attention was given to live-stock improvement. Seven cow-testing associations and one breeders' association were organized. Records were kept in these associations of 4,091 cows and 550 were eliminated as unprofitable. As a result of the work with the cow-testing association, 213 farmers were persuaded to adopt balanced rations for their herds, 35 registered bulls and 107 registered cows were secured, and 191 animals were tested for tuberculosis. To bring about increased production by soil improvement, 155 farmers were encouraged to add acid phosphate or lime-rock phosphate to barnyard manure, and 175 farmers were induced to mix 370 tons of commercial fertilizer at home. The agents tested the soil on 188 farms for acidity, and 865 tons of lime were used at their suggestion. Four hundred and fifty-five farmers were induced to keep farm accounts and 156 farmers modified their plans of farm management, the need having been shown them in part by farm accounts and farm-analysis records. The agents assisted in organizing 19 farmers' exchanges and purchasing and marketing associations, which did more than \$200,000 worth of business with a saving of \$12,442 to the farmers. Agents also arranged for and supervised

562 definite demonstrations, involving 553 acres of crops and 551 head of live stock.

Special campaigns were also conducted to increase crop and live-stock production. One hundred and sixty-six farmers were assisted in securing seed oats, 290 farmers in securing seed corn, and 752 farmers in securing 7,765 bushels of seed potatoes. Three thousand six hundred and fifty additional acres of potatoes were raised, increasing the production more than 200,000 bushels; and 1,727 additional acres of beans were raised, increasing the production 14,590 bushels. Two thousand one hundred and forty-four persons were assisted in home gardening, and 963 farmers received information regarding the storing of fruit and vegetables. Six hundred and seventy-eight canning demonstrations, exclusive of club work, were held for women, and as a result 56,500 additional quarts of fruit and vegetables were canned.

In doing the work the agents made 5,620 visits to farmers, gave information to 6,342 persons at their offices, and took part in 849 meetings, attended by 44,140 persons.

Home economics.—On January 1, 1917, the State-wide force consisted of one worker, whose attention was given mainly to the teaching of foods and cookery. Work was conducted through clubs, home visits, and in a few instances through local leaders trained to give demonstrations. Two counties were organized for permanent home-demonstration work at this time also. During the past summer the college, in cooperation with the State public safety committee, employed 31 home-economics teachers in a 6-week food campaign. These workers received 1 week's training at the State agricultural college. Through the resignation of the specialist in charge of the State-wide work, the supervision of all women's extension work in the State was handled by the head of the home-economics department in cooperation with the women's committee of the State council of national defense. On December 31, 1917, the home-demonstration staff numbered six county agents, five district agents, and one urban agent.

Urban home-demonstration work in the State was done by three agents, one resident in Manchester, and two dividing their time among several cities in two districts, including Concord and Portsmouth. Demonstrations for organized groups have been given and an effort has been made to reach the large foreign population in industrial centers.

Boys' and girls' club work.—A State leader, 3 assistant State leaders, and 78 volunteer leaders supervised the boys' and girls' club work. Seventy-three club groups were organized with a total enrollment of 2,470 members, who reported products to the value of

\$13,364.09, produced at a cost of \$7,641.18. The club leaders conducted 78 canning demonstrations, with a total attendance of 2,941, also 32 field demonstrations, 24 club fairs and festivals, 6 leadership-training schools, and 24 local county and State club exhibits. They visited 2,164 club plats during the year. Forty per cent of the club members had done work in the preceding year.

The table following gives some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....		35	8.77 acres.....	364.5 bushels..	\$794.78	\$558.15
Potato.....		173	19.3 acres.....	3,588 bushels..	5,381.88	2,595.53
Home garden.....		147	901 square rods.....	1,027.42	602.86	
Sweet corn.....		24		2,009 dozen ears	281.28	128.77
Poultry.....		20	117 fowls.....	563 chicks, 812 dozen eggs.	683.74	437.33
Pork and crop.....		29	33 pigs.....	5,691 pounds..	1,047.53	907.84
Canning.....	54	339		10,966 quarts, 304 glasses jelly.	4,061.29	2,245.03
Garment making.....	19	66		218 pieces.....	151.95	165.57
Total.....	73	833			13,429.87	7,641.18

Total club enrollment, 2,470.

Farm-management demonstrations.—During the year the farm-management demonstrator devoted his full time in eight counties teaching farmers how to study their business. Five hundred and nine farmers began doing this by starting simple farm accounts. Practically all the farm-account books placed were kept throughout the year. Farm-analysis records were taken on 165 farms. These and 31 other records taken the previous year were returned and discussed personally with the farmers. As a result of farm-management demonstration work, 156 farmers changed their management in order to increase their labor incomes.

Dairying.—Supervision of 12 active cow-testing associations, involving 317 herds of 4,790 cows, was continued. One new association was organized. This project is in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture.

Orchard and vegetable-garden demonstrations.—The work of these projects was interrupted by the resignations of the specialists in charge, and the projects were later discontinued.

SURVEY.

With a farm bureau and county agent in every county and with State legislation permitting ample financial support, New Hampshire

now has a State-wide organization for extension work. Cooperation with the State committee on public safety has been of value in war campaigns for larger production and conservation of food. As in other States, the work of several departments was interrupted by changes of personnel. The work of the cow-testing associations has had a large influence upon the dairy industry of the State, and they have proved to be a valuable means of extension work. The organization of farmers' exchanges and marketing associations by the county agents has resulted in a decided economy upon a considerable volume of business.

NEW JERSEY.

Extension Division of the New Jersey Agricultural College Experiment Station, *New Brunswick.*

ALVA AGEE, *Director.*

Organization and administration.—There has been no material change in the extension organization, the duties and relationships of principal officers remaining as formerly reported. The director of extension was assisted by a State leader and assistant State leader, who are in charge of county farm demonstration; a group of specialists that are responsible directly to the director of extension, but work in closest relations with subject-matter departments; and a home-economics leader and a boys' and girls' club leader, who has assistant State leaders. There was no change in relations to the State institutions. The State department of agriculture has turned the farmers' institute work over to the division of extension, and, likewise, all educational work with county boards of agriculture. The staff of the State department of agriculture and that of the division of extension work were in closest harmony. The division of extension formed such cooperative arrangements with the State department of public instruction that the vocational school director of Atlantic County became the county farm demonstrator for that county. The public-school system cooperated closely with the State club leader in the conduct of boys' and girls' club work. The division of extension cooperated with the State department of labor in the placing of labor on farms.

Publications.—Three bulletins with a total of 114 pages, 7 circulars, 2 leaflets, 11 numbers of the Farm Demonstration Exchange, and 52 News Letters were published during the year. In addition to these, the State board of agriculture published in very large editions three bulletins on Canning and Drying, Food Preparation, and Home Gardens, prepared by the extension service.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith Lever, Federal	\$24, 032. 96
Smith-Lever, State	14, 032. 99
United States Department of Agriculture, farmers' cooperative demonstration work.....	8, 998. 72
State appropriations	10, 794. 67
County	19, 173. 38
Other sources within the States.....	600. 00
Total.....	77, 632. 75

Smith-Lever funds have been used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, agronomy, fruit growing, market gardening, poultry husbandry, and dairying. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, home economics, and boys' and girls' club work.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents June 30, 1916, 11; June 30, 1917, 10. Work was temporarily discontinued in one county. A county-agent leader supervised the work.

Among the results of the activities of the agents during 1917 were the following: One hundred and ninety-one farmers followed suggestions of agents in growing potatoes on 1,003 acres; considerable attention was given to the production of more legumes, both for live-stock feeding and soil improvement, resulting in 261 farmers sowing 1,709 acres of alfalfa; 54 farmers raised 493 acres of soy beans and 44 farmers raised 457 acres of cowpeas, according to methods recommended; 228 farmers were induced to follow suggestions in orchard management, affecting 128,258 fruit trees; 4 cow-testing associations were organized, and 2,986 cows were under test, resulting in the elimination of 204 cows as unprofitable. The agents vaccinated 813 hogs for cholera; 129 farmers used 785 tons of chemical fertilizers and 791 acres of hay land were top-dressed as recommended. The agents tested soil for acidity on 279 farms, 1,561 tons of lime were used at their suggestion, and 1,323 acres of clover were plowed under for soil improvement. The county agents arranged for and supervised 1,236 demonstrations involving 2,443 acres of crops and 2,154 live stock.

In addition to the above work the agents conducted special campaigns to increase crop and live-stock production to meet war needs,

resulting in 1,981 additional acres of corn, 2,441 additional acres of potatoes, and 722 additional acres of beans being produced, thereby increasing the production of crops as follows: Corn, 821,650 bushels; potatoes, 108,192 bushels; and beans, 7,665 bushels. One thousand four hundred and thirty-one farm laborers were secured for farmers by agents or through their offices, and 167 farmers were assisted in securing 1,051 tons of commercial fertilizers. Assistance was given in organizing 7 farm-loan associations. Three hundred and sixty-four farmers received information regarding storing fruit and vegetables, and 105,600 quarts of vegetables and fruit were canned as a result of canning demonstrations arranged primarily for women.

In doing their work the agents made 10,071 visits to farms, gave information to 8,154 persons at their offices, and took part in 2,073 meetings, attended by 52,474 persons.

The most far-reaching developments in the work during 1917 was the reorganization of the county boards of agriculture on a community basis, and their taking over the local responsibility for county-agent work. This is very similar to the farm-bureau plan of having a working committee for each community in the county. Although a membership of farmers who pledge their cooperation is secured, there is no membership fee; 3,157 persons were enrolled in such associations. Special emphasis was placed on the importance of follow-up work, both on regular demonstrations and emergency work of a miscellaneous character.

Home economics.—Until August, 1917, a leader and three assistants gave lectures and demonstrations before women's organizations, farmers' institutes, county fairs, and other organized groups, as requests were received by the extension department. The subjects presented were home sanitation, the household budget, the farm woman's income, and the selection and preparation of foods. During May and June, 127 lecture demonstrations on canning were given, the attendance being 14,444. The chief war work was in canning, drying, salting, pickling, etc. In this work a canning bulletin was issued in five languages by the State department of agriculture. During the summer three counties employed home-demonstration agents. Seven emergency agents were placed in counties and cities where a willingness was shown to bear a small part of the expense during September and October, 1917. Eight community canning centers were organized in the State and thousands of quarts of fruits and vegetables were thus conserved which otherwise would have been wasted. A "Canning Special" train was operated for two weeks in cooperation with one of the railroads, on which canning demonstrations were given each afternoon and evening.

The city work was supervised by an assistant State leader. Work was organized in 6 cities before January 1, 1918. In each city,

cooperation was secured from the social, religious, and civil agencies. In each of the districts into which the cities were divided, volunteer leaders, trained by the home-demonstration agent, organized clubs for demonstrations and helped the club leaders to direct the follow-up work in the homes. Foods, marketing, sanitation, and clothing were studied. Special demonstrations were given at factories for industrial workers.

Boys' and girls' club work.—Four thousand one hundred and twenty-six members were enrolled in the 131 boys' and girls' clubs. The products of the 379 members who submitted complete reports were valued at \$9,939.80 and were produced at a total cost of \$1,695.88. The club leaders held 183 meetings during the year, with a total attendance of 11,014. One hundred and thirty of these were meetings of the clubs, with an attendance of 6,670. Forty-six demonstrations in canning, 5 drying demonstrations, 14 in bread making, 28 fireless-cooker, 6 cooking, 3 milk-and-egg, and 15 vegetable-cooking, and 37 other demonstrations were given during the year. These 154 demonstrations were attended by a total of 14,643 club members, women and men. Eighteen club fairs and festivals were conducted and 23 local county and State club exhibits were held. Three hundred and sixty-five club plats were visited during the year.

Although the club work included seven projects, complete reports were made for but two of them. Ten corn clubs, with 110 members, reported 114 acres producing an estimated crop of 8,550 bushels, and 4 pork clubs, with 58 members reporting, produced 7,250 pounds of pork.

In food production and food conservation, an enrollment of 1,733 club members, was reported in home-garden work, each of which took care of a garden containing from 250 square feet to one-half an acre. In the home canning, 1,500 members were enrolled, who canned for home use in glass jars and tin cans 129,383 quarts of fruits and vegetables. Under the emergency work in poultry, 439 boys and girls managed 5,000 fowls.

As a result of a number of conferences with the State department of public instruction, county superintendents of schools, and county agricultural agents, a satisfactory understanding of the relationship of these different parties in club work and their cooperation in a definite plan of work has been secured. This involves the employment of a limited number of teachers as county club leaders for part time during the school year and for their entire time during the summer months. In organized counties the work is to be carried on through a county leader, who will work under the direction of the State leader in consultation with a county advisory board, which will consist of the county superintendent of schools, the county farm

demonstrator, a representative of the board of agriculture, and representatives of such other organizations and such individuals as the committee may invite.

Agronomy.—Community corn-test demonstrations were made in 7 communities on 31 farms in the same manner as last year. The number of strains tested in a demonstration varied from 8 to 17; the lowest variation in yield was 13 bushels per acre and the highest variation 40 bushels per acre. This project is showing the farmers that certain local strains of corn if generally planted would greatly increase the average yield in the community. The data from 47 farm-management surveys in two counties was tabulated and 44 farm records were taken in Mercer County at the request of the farm bureau.

Soils and crops.—Twelve half-acre plats were established, chiefly in the southern part of the State, to demonstrate how poor or run-down land can be brought to a state of profitable production without the use of manure or nitrogenous fertilizer. These plats are to be improved by plowing under green-manure crops, such as cowpeas, rye, and vetch, and applications of acid phosphate and ground limestone. The plats were planted in corn and showed an average increase of over 100 per cent. Field meetings were held in cooperation with the county agent at three of the best plats in each county when the crop was harvested. Two new plats were started this year. Demonstration plats of alfalfa seed from different sources were planted in 15 different fields. This work is being continued by the experiment station and State alfalfa association. Assistance has been given several farmers in laying out farm-drainage systems.

Fruit growing.—The work of this project was handicapped by frequent changes of the extension specialist. Seventy orchard-management demonstrations were conducted with the cooperation of the county agents. These involved pruning, spraying, and control of insect pests, top-working, etc. A survey was made of 115 peach farms near Vineland. Considerable work was done in cooperation with the State bureau of markets in aiding peach growers to pack and market their crops properly. Packing schools were held to train packers. The owners of 20 peach orchards cooperated in testing the use of a mixture of sulphur, hydrated lime, and glue as a substitute for self-boiled lime-sulphur for a summer spray. The mixture proved equally as effective as the lime-sulphur in the control of peach scab and brown rot. Ninety-five meetings were held with an attendance of 3,100, and 750 farms were visited.

Market gardening.—Particular attention was given to encouraging the planting of home gardens in towns and cities. Twelve cooperators tested the poisoned-bait solution for the control of the onion-root maggot. Twenty-four cooperators were assisted in the produc-

tion of disease-free sweet potatoes. One grower secured 35½ baskets more per acre by this method. Strains of seed resistant to the cabbage yellows were secured from Wisconsin and distributed to 100 growers. Many of the growers found that this strain produced well alongside others which failed, and are saving seed from the best plants. A test of the strains of early tomatoes grown in Gloucester County was made. The State was urged to plant field beans as a war measure through a special circular on "Field Bean Production," and it is estimated that the crop was increased by 50,000 bushels. Demonstrations were made in the control of the corn earworm by spraying and of the striped cucumber beetle by the use of tobacco dust and lime. The specialist attended 69 meetings with an attendance of 8,476.

Poultry demonstrations.—Thirty-four caponizing demonstrations were given in 14 counties before 361 people, 106 persons being taught by actually operating on from 1 to 10 birds. Four demonstrations in killing and picking and 18 demonstrations in testing incubator eggs were held. During the fall most of the specialist's time was devoted to a campaign for the culling of nonproducing birds, 81 demonstrations being given in 20 counties, with 1,762 persons present. Of the 22,542 birds gone over, 10,668, or 48 per cent, were culled out as unprofitable. The culling out of 47 per cent of 7,532 of these birds reduced production by but 1 per cent on the basis of the whole number of birds, thus cutting down the feed cost practically one-half. Chick-raising contests are being continued. Thirty-two poultrymen cooperated in keeping records of the cost of hatching chicks and 26 reported complete records, showing the average cost of 5,187 chicks to be \$0.0778. Eighty-eight multiple-unit houses were constructed according to plans and prints furnished by the specialists, and 144 old poultry houses and farm buildings were remodeled. Five hundred and ninety visits were made to farmers, 237 lectures were given before 10,511 persons, and 154 educational demonstrations were given with an attendance of 2,274.

Dairying.—Supervision was given 8 active cow-testing associations, involving 135 herds of 3,195 cows, 3 of which were organized this year. Twenty-five calf-feeding demonstrations were carried on in seven counties, with the use of home-mixed calf meal. In one demonstration 90 calves made a growth of 1.1 pounds per day at a cost of 12 cents per pound of gain. Five junior cow-testing clubs were organized as a result of milk-testing demonstrations given at schools, and 4 calf-raising clubs were organized. Five hundred and seventy farms were visited during the year.

SURVEY.

The reorganization of the county boards of agriculture on a community basis, so that they become responsible for the work of the

county agent, gives the extension service the support of local organizations with a membership in every community, which will make possible the better planning of work to meet local problems. The extension division of New Jersey is unique in its close relation to the State department of agriculture, which has had manifest advantages for meeting a war situation. Boys' and girls' club work has been placed on a firmer basis by a definite plan of organization, supported by the State school system and the county boards of agriculture. The extension specialists are carrying on cooperative variety tests and soil-fertility plat demonstrations, which, though of a more or less experimental nature, seem to be necessary as a means of extension teaching, and may be warranted in sections with such a highly specialized type of agriculture. The work in the culling of poultry is particularly striking. With the better local organization of home-demonstration work, which was contemplated at the close of the year, New Jersey will have an extension organization well adapted to its needs.

NEW MEXICO.

Division of Extension, New Mexico College of Agriculture and Mechanic Arts, *State College*.

A. C. COOLEY, *Director*.

Organization and administration.—No change has been made in the plan of organization during the year. County home-demonstration work, veterinary extension work, and extension work in agronomy were added to the lines of work being done. The rapid extension, due to the war, in all the lines of work made it necessary for the director to give up the supervision of the county-agent work and to devote his entire attention to administrative work. This made it necessary for the assistant county agent to devote all his time to county-agent work, and the farm-management demonstration work was dropped temporarily. After war was declared, an assistant county-agent leader, an assistant State demonstrator in home economics, a State leader of county home-demonstration agents, a farm-help specialist, a veterinary specialist, and an agronomy specialist, 13 temporary county agents, 9 assistant county agents, 11 home-demonstration agents, and a stenographer were added to the force, the extension work was extended to include the entire State, and work was taken up in food production and conservation. The rapid and immediate expansion was made possible by the fact that a special session of the legislature appropriated \$750,000 for emergency activities, of which amount \$35,000 was turned over to the college; passed an act authorizing the county commissioners in any county to levy a special tax for agricultural-extension work, and providing that the State

should meet such county appropriations dollar for dollar up to \$2,000 per county.

Publications.—One home-economics circular, 1 county-agent circular, 9 boys' and girls' club work circulars, 65 mimeographed leaflets, ten 5 by 9 inch mailing cards on timely subjects, and 12 issues of the New Mexico Farm Courier, were published during the year.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal.....	\$16,257.54
Smith-Lever, State.....	6,257.54
United States Department of Agriculture, farmers' cooperative demonstration work.....	10,510.69
Bureau of Biological Survey.....	750.00
Bureau of Animal Industry.....	1,400.00
College.....	859.53
State appropriations.....	7,687.81
County.....	14,709.04
Other sources within the State.....	404.51
Total.....	58,836.66

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, farm-management demonstrations, extension schools, and dairying. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, boys' and girls' club work, farm-management demonstrations, dairying, and control of mammal pests.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents, June 30, 1916, 9; June 30, 1917, 11. Work was supervised by the director of agricultural extension serving as county-agent leader, with one assistant.

Among the outstanding results of the activities during the year were the following: Five hundred and thirty-one farmers selected seed corn at the suggestion of agents, resulting in 4,555 additional acres being planted with selected seed; 545 farmers treated their seed oats for smut for 51,720 acres; and 3,015 acres of clover were plowed under for green manuring. One cow-testing association was organized bringing 300 cows under test; 50,807 animals were treated for blackleg; and 121 additional silos were built. Twelve buying and selling associations and farmers' exchanges organized with the assistance of agents did \$166,000 worth of business at considerable saving

to the farmers. The agents arranged for and supervised 577 demonstrations involving 24,608 acres of crops and 5,091 live stock.

In addition to the above work the agents helped to stimulate crop and live-stock production to meet war needs. Seed was secured for farmers as follows: Seed wheat, 14,484 bushels; seed corn, 10,146 bushels; 1,296 farmers were assisted in securing 4,515 bushels of seed beans. The wheat acreage was increased by 48,340 acres; the corn acreage was increased by 8,890 acres, increasing the production 151,250 bushels; and the bean acreage was increased by 31,126 acres, increasing the production nearly 100,000 bushels. Seven tractors were rented or loaned to farmers through county agents' offices, increasing the number of acres under cultivation 2,500. The agents assisted in organizing 19 farm-loan associations, and 101 canning demonstrations were held for women, aside from club work, resulting in 39,820 additional quarts of fruit and vegetables being canned.

In doing the work the agents made 8,382 visits to farms, gave information to 8,807 persons at their offices, and took part in 907 meetings attended by 47,024 persons.

Home economics.—Since New Mexico has a small scattered population and funds were lacking, home-economics extension work advanced slowly until June, 1917. One State-wide home-economics worker did what she could to teach the principles of right living and to improve home conditions in rural districts. When war was declared the home-economics staff was increased from one to six permanent home-demonstration agents and two additional emergency demonstrators to work during the summer. The initial work of the force was to teach food conservation. Preparation for this campaign was made in a training school at the college. Large quantities of perishable foods were conserved. Special demonstrations were given to increase the use of beans and feterita, two crops grown extensively in parts of the State. By the end of the year 685 demonstrations had been given in canning and drying fruits and vegetables, with an attendance of 17,056. Housewives as a result of these demonstrations canned 176,242 quarts of fruits, vegetables, and meats, valued at \$44,060.50. The home products dried amounted to 27,848 pounds, valued at \$3,169.20. Five hundred and twenty dozens of eggs were preserved, resulting in a saving of \$163.80.

Boys' and girls' club work.—The boys' and girls' club work was conducted by the State leader and 15 assistant club leaders paid cooperatively and employed temporarily; 136 unpaid volunteer leaders also assisted in the work in their respective communities and were responsible for 50 per cent of the results of club work.

Two hundred and ninety-one club groups were organized, with a total enrollment of 2,234 members. Of this number 638 members completed the work and reported products to the value of \$18,137.36,

at a total cost of \$6,255.38. Sixty per cent of the club groups were enrolled in 1916. The club leaders conducted 21 canning demonstrations, with a total attendance of 738 club members, women and men. Eighty-two club plats were visited during the season.

The following table gives some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	24	38	26½ acres.....	867 bushels....	\$1,517.25	\$298.20
Potato.....	2	12	4 acres.....	1,361 bushels..	1,482.40	233.32
Bean.....	38	85	90 acres.....	39,299 pounds	3,698.25	983.10
Broom corn.....	5	3	3 acres.....	1,500 pounds..	236.50	39.78
Milo and kafir.....	5	12	12 acres.....	16,305 pounds	327.10	78.39
Wheat.....	1	2	31 acres.....	169½ bushels..	329.40	254.33
Poultry.....	44	88	.....	1,756 chicks....	1,527.42	824.47
Baby beef.....	2	4	4 animals.....	.....	160.00	80.35
Pork and crop.....	40	51	58 animals.....	8,722 pounds..	1,344.21	605.05
Canning.....	22	111	.....	2,434 quarts..	3,540.61	979.66
Bread.....	46	101	.....	6,919 articles..	2,306.85	1,043.67
Garment making.....	62	131	.....	432 garments..	1,667.37	\$35.06
Total.....	291	638	.....	.....	18,137.36	6,255.38

Total club enrollment, 2,234.

Dairying.—The dairy extension work was largely centralized in two dairy sections, and but little work was done in counties where there were no agricultural agents. Silo construction was emphasized and 12 were built in one county which previously had none. One cow-testing association was organized, representing 275 cows and 17 herds. Assistance was given in the selection and purchase of 10 pure-bred bulls, 2 pure-bred cows, and 163 grade cattle. Three dairy associations were organized and instruction was given at four extension schools. This work is in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture.

SURVEY.

During the latter part of the year the extension service in New Mexico made a rapid growth on account of the pressure of work caused by the war. The apportionment of funds from the State's emergency appropriation and the act encouraging the counties to raise a generous portion of the county budget for extension work were gratifying evidence of public confidence in the work of the extension force. The work of the county agents in the organization of farm-loan associations, cooperative-selling associations, and farmers' exchanges was particularly significant. Home-demonstration work was inaugurated at the end of the year. Boys' and girls' clubs

made fine growth, and the large proportion of the members who had been enrolled the previous year shows their appreciation of the work.

NEW YORK.

Division of Extension, New York State College of Agriculture, Ithaca.

A. R. MANN, *Director*; M. C. BURRITT, *Vice Director*.

Organization and administration.—There were no changes in the administration of the extension organization or in its relations to other parts of the institution or to other institutions. At the end of the year the director of farm bureaus was made vice director of extension, in immediate charge of extension work. The head of the department of extension teaching resigned to enter commercial agricultural work in China. There were no organic changes in the extension service to meet the war emergency, but many members of the extension staff devoted their time (both official and vacation time) largely to emergency work throughout the spring and summer. The following are samples of emergency work done: The dean and director of extension was appointed a member of the New York State food supply commission, which operated from April 13 to October 18. In the organization of the commission he was made secretary and commissioner in charge of food conservation. The director of farm bureaus was also a member of the New York State food supply commission, and was made commissioner in charge of county organization. The ranking professor of extension teaching served as his assistant. An organization largely made up of college men, and including both resident teachers and extension teachers, was created by the New York State food supply commission for the control of insect pests and plant diseases of fruits, potatoes, vegetables, and cereals. Utilizing almost the entire staff of the home-economics department, the commission organized a food-conservation service, which began operations just after the close of the fiscal year 1917. Other work in poultry husbandry and in drainage was taken up in cooperation with the commission, but, since it follows in the next fiscal year, is not included in this report.

Publications.—During the year the extension material handled by the office of publication, which includes the information service of the college of agriculture, was notably increased in many respects. Special effort was made to reach the farms and the homes of the State with brief practical printed matter, either in publications, in reference cards, or in news notes published by the press. After February, 1917, this matter was mainly directed toward a greater production and conservation of food. The aggregate mailing lists for the four classes of extension publications are: Reading course

for farm, 22,739; reading course for farm home, 65,000; rural-school leaflet (teachers), 55,000; rural-school leaflet (children), 225,000.

The aggregate number of publications issued was as follows: Reading-course lessons for farm, 374,000; reading-course lessons for farm home, 485,000; extension bulletins, 188,000; rural-school leaflets, 742,000; farm-bureau circulars, 6,000; mailing cards, 1,840,000; total, 3,635,000.

During the year 339 news items were issued to the press. From clippings and newspapers the actual known circulation for all of the news items was 39,331,422.

Finances.—The following funds were available for cooperative-extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$52, 978. 32
Smith-Lever, State	42, 978. 32
United States Department of Agriculture, farmers' cooperative demonstration work	25, 893. 87
Bureau of Animal Industry	354. 85
College	3, 270. 19
State appropriations	48, 947. 58
County	124, 428. 61
Total	298, 851. 74

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, farm-management demonstrations, extension schools, demonstrations in culture of field crops, control of insect pests, fruit culture, control of plant diseases, animal husbandry, soil drainage, farm forestry, relation of birds to agriculture, poultry industry, and landscape art. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, home economics, boys' and girls' club work, farm-management demonstrations, and dairying.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents June 30, 1916, 36; June 30, 1917, 41, with 41 county agents and 3 assistants. The work was supervised by the county-agent leader and two assistants.

Among the results during 1917 were the following: One thousand six hundred and thirty-five farmers selected seed corn in the fall for 12,424 acres; 8,936 acres of corn were raised for silage by 1,647 farmers according to methods recommended; 6,056 farmers treated seed oats for smut for 55,200 acres; and 2,850 farmers treated seed

potatoes for the control of potato diseases, resulting in 12,006 additional acres being planted with treated seed. Methods for growing potatoes recommended by agents were used by 2,112 farmers on 21,661 acres. Considerable attention was given to encouraging the growing of legumes for live-stock feeding and soil improvement, and as a result 409 farmers sowed alfalfa, 499 raised soy beans, and 398 raised vetch. Two thousand seven hundred and sixty-one farmers followed recommended methods of orchard management in their orchards, which included 231,986 trees. To bring about live-stock improvement, 19 cow-testing associations were organized and 14,152 cows were under test, resulting in the elimination of 711 cows as unprofitable. In addition, 5,001 other cows were under test by individual farmers, who kept records under the direction of the agents. As a result of the 14 breeders' associations which the agents helped to organize and the work of the cow-testing associations, 122 registered bulls and 248 registered cows were secured, and 314 farmers adopted balanced rations for their herds. One hundred and twenty-four drainage systems, covering 5,197 acres, were planned and installed. One thousand two hundred and fifty-four farmers received information in regard to the use of chemical fertilizers, and 3,035 tons of fertilizers were used as recommended. Soil acidity being a great handicap to maximum production, the agents tested soil on 565 farms for acidity. Forty thousand and forty-one tons of lime were used and 5,393 acres of hay land were top-dressed at the suggestion of agents. The 54 purchasing and marketing associations which the agents assisted in organizing did more than \$4,000,000 worth of business and saved the farmers \$479,192. The agents conducted 3,285 definite demonstrations, involving 34,542 acres of crops and 2,036 live stock. Demonstrations most generally showing the control of oats smut and potato diseases, orchard management, and the elimination of unprofitable hens by careful selection were those carried on.

After the declaration of war, immediate steps were taken to mobilize the agricultural forces of the State, and State funds were made available for placing emergency food agents in the 15 agricultural counties not having regular county agents. The entire farm-bureau force of the State was used in taking an agricultural census, distribution of seed, supplying laborers to farmers, and distribution and operation of labor-saving machinery. Nine thousand eight hundred and twenty-one bushels of seed wheat were secured for 1,815 farmers; 28,690 bushels of seed buckwheat for 8,470 farmers; 142,558 bushels of seed potatoes for 12,977 farmers; and 13,698 bushels of seed beans for 2,440 farmers. The agents also helped farmers to secure 10,207 bushels of seed oats and 14,697 bushels of seed corn,

in addition to 59,370 bushels of seed corn secured or located for the 1918 crop. The campaigns resulted in the following increased production of crops: Wheat, 67,259 acres; oats, 55,007 acres and nearly 1,000,000 bushels; corn, 42,690 acres and more than 500,000 bushels; buckwheat, 35,160 acres and 220,405 bushels; potatoes, 38,109 acres and 2,500,000 bushels; beans, 17,838 acres and 127,648 bushels.

The labor shortage was a serious problem in the State, and the agents gave a large amount of time to this problem. Twelve thousand nine hundred and fifty-three applications were received from farmers for farm or household help, and 14,712 laborers were furnished through county-agent offices or farm-labor bureaus. Three hundred and sixty-four farmers were assisted in hiring or securing the loan of 77 farm tractors, which were used to plow 11,108 acres of land. Five hundred and twenty-five farmers were assisted in securing the use of power sprayers. The agents assisted in organizing 22 farm-loan associations and helped 868 farmers to secure credit for purchasing machinery, seed, fertilizers, feed, etc. Seven hundred and eighty-six canning demonstrations were arranged for adult women, resulting in 152,780 additional quarts of fruit and vegetables being canned.

In doing the work the agents made 27,353 visits to farms, received 53,486 calls at their offices for information, and took part in 4,938 meetings, attended by 259,496 persons.

Special emphasis was placed on extending and improving the farm bureau community work by introducing more definite plans, programs, and follow-up work. Eleven new counties were organized during the year. On December 1, 1917, there was a farm bureau in every county having a county agent, and the total membership of farm bureaus was 27,831. The total farm-bureau membership in the State has more than doubled during the year, and the average membership per bureau increased from 398 to 633. Five thousand community committeemen are at work, most of whom fully grasp the farm-bureau idea and practically all community committees have taken definite steps to improve the agriculture in their community.

Home economics.—Five home-demonstration agents were engaged as permanent workers in as many farm bureaus. The farm bureau is organized with coordinate agricultural and home-economics departments, each with its executive board, the two boards uniting to form the executive board of the farm-bureau association. In June, 1917, a campaign was begun to place conservation agents in such counties as would cooperate by forming temporary organizations and furnishing office accommodations and necessary expenses. The State was charted into five districts, each under a district agent, who acted as organizer and supervisor. Three emergency training schools, each

lasting from one to two weeks, were held at the college to prepare home-demonstration agents for the field. On December 1, 1917, agents were at work in 42 counties. A leader and four assistants direct this work. Community kitchens were established in several counties where surplus food materials were canned and women received information on canning with the use of equipment available in the average kitchen. Through the efforts of workers in these centers immense quantities of fruits and vegetables were preserved. The extension service carried to the field instruction in food, shelter, and clothing through five distinct lines of communication as follows: (1) Extension publications prepared by the college staff and sent regularly to 66,847 readers. (2) Extension schools of five days' duration held in 34 counties. A total of 44 schools were held last year. (3) Study clubs for which home-economics programs are prepared. There are 241 clubs, with an average individual membership of 25. (4) A railroad car containing canning equipment was sent over the State demonstrating on a large scale efficient methods of utilizing the food supply. There were five extension specialists to carry out this project. (5) Widespread informational publicity in the press of the State through the information service at the State college of agriculture.

New York was one of the first States to call for emergency funds for city work. These funds were used to provide 25 agents in 8 cities to supplement those provided by the New York State food supply commission, whose conservation work was directed from the State college of agriculture. After the New York State food commission was organized the conservation work in cities was transferred from Federal and State college funds to State funds, New York being the only State in which the urban work is not done in cooperation with the Federal and State agencies provided for by the Federal food production bill.

Boys' and girls' club work.—Thirty-three thousand nine hundred and fifty-six club members were enrolled in the work in agriculture and home economics, of whom 15,190 reported products valued at \$55,927.03, produced at a total cost of \$24,300.66. One hundred and fifty club plats were visited during the year and 30,000 pieces of club literature were distributed to club members by the State. The work was conducted by one State club leader and one assistant club leader employed cooperatively on full time and 12 assistant club leaders employed cooperatively on part time. The work was assisted by the help of volunteer unpaid leaders, consisting mostly of school-teachers and school supervisors.

The following table gives some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....		64	51½ acres.....	896 bushels.....	\$1,246.00	\$466.55
Potato.....		340	154 acres.....	16,329 bushels.....	19,985.15	9,712.66
Home garden.....		13,714	247½ acres.....		18,301.00	5,530.00
Poultry.....		227	9,458 fowls.....		9,936.88	5,794.45
Pork and crop.....	2	80	80 pigs.....	12,000 pounds.....	1,920.00	1,300.00
Canning.....		765			4,538.00	1,497.00
Total.....	2	15,190			55,927.03	24,300.66

Total club enrollment, 33,956.

Besides the results reported above, which were chiefly those of rural boys and girls, there was a large enrollment of boys and girls in the larger cities who produced war-emergency gardens. In Chemung County alone the club achievements are represented by the following results: Four hundred and eighty-seven chickens and 2,088 dozen eggs produced, 295 bushels of potatoes grown, 147 war gardens tended, 2,057 jars of fruit and vegetables canned, 539 loaves of bread and 841 cakes baked, 173 garments made, and 5,818 pieces of handicraft constructed, at a total value of \$4,996.17. In addition to the above amounts produced by the members of the Achievement Club and other boys and girls over 1,000,000 jars of fruits and vegetables were put up in Chemung County, largely the result of continuous demonstrations given during the summer by the county club leader and the teams of boys and girls that assisted him.

Farm-management demonstrations.—Work was conducted in eight new counties during the year, making a total of 26 counties in which work was done. County agents assisted 298 farmers to study their business by means of simple farm accounts. Farm-analysis records were taken on 305 farms. These and 276 others taken the preceding year were summarized, returned, and personally discussed with the farmers.

Extension schools.—Fifty-seven extension schools were held in 35 counties, with a total enrollment of 1,799, the average attendance per session being 19.28. Only two subjects were presented usually, the subjects being chosen by a local committee with the advice of the county agent and a representative of the central office. The laboratory method was utilized as far as possible in stock judging, grading eggs, study of feeds, killing and picking poultry, microscopic examination of fungus organisms, pruning, grafting, soil testing, and the like. The tendency is toward a further specialization of the sub-

ject matter within a given school, and an increasing number of schools devoted specially to poultry, fruit, dairying, etc., are being requested.

Demonstrations in culture of field crops.—The object of this project was to conduct demonstrations among farmers in the improvement and fertilization of meadows, the improvement of potato production, and alfalfa culture, to conduct work with farm crops in extension schools, and to aid with other extension activities in farm crops. Oats-variety tests were carried on in several counties. A total of about 500 plats for demonstrating the relative value of different varieties of silage corn were used. Demonstrations were made in the fertilization and top-dressing of meadows. Hill selection and tuber-unit selection of potatoes were demonstrated. Alfalfa demonstrations were laid out in practically every county with a farm bureau. Demonstrations with sweet clover, flax, winter vetch, soy beans, and rotation methods were also made.

Control of insect pests.—Most of the demonstration work under this project was carried on in cooperation with the farm bureaus. Demonstrations of the comparative value of dusting and spraying apples were conducted. Exhibits were made at the State fair, at several local fairs, and at the meetings of the two State horticultural societies. Instruction was given at five extension schools held in fruit-growing sections.

Fruit culture.—The principal lines of work covering a period of years are renovating an old apple orchard, the use of nitrate of soda in an apple orchard, and commercial fertilizers on peach trees and small fruits. There were 54 demonstrations in bridge grafting apple trees and pruning and packing fruit, with an attendance of 1,302 persons. At the 9 extension schools 40 lectures were given to 261 people. Among the miscellaneous activities were fruit judging at 9 shows, grading and packing fruit, and budding and grafting trees at the State fair, visits to advise 151 farmers about spraying and other orchard operations, and the giving of 27 lectures on fruit topics.

Control of plant diseases.—Improvement of potatoes by means of control of diseases was one of the principal features of this project. Instruction was carried to the farmers by means of demonstration cars, farm demonstrations of seed treatment, selection, and spraying, and by potato seed inspection and exhibits. The fruit-disease control work consisted of cooperative dusting and spraying demonstrations for the control of diseases of apples, peaches, and cherries. Telephone relay systems were an effective means of warning of rain predictions and were of considerable assistance in obtaining adequate results from spraying.

Animal husbandry.—This project received the full time of 3 persons and of an additional assistant for 3 months. The work was carried on largely with the county agents and its results were reported by them. Thirty farms conducted stock-judging demonstrations, including those given at extension schools, and 20 farms conducted feeding demonstrations. Instruction was given at 25 extension schools. Sheep cars were operated over two railroads for 5 weeks, and instruction was given at 79 stops to an average of 88 persons at each station. The exhibits in these cars dealt with various grades of sheep and their special uses, together with instructions for breeding, feeding, and care, and different grades and classes of wool with charts showing the range of prices and production of wool.

Soil technology and drainage.—The demonstration work was carried on in cooperation with the farm-bureau managers on a definitely organized plan, but as it has not been in full operation the reports for which it provides are not yet available. Reports from 20 counties show 235 demonstrations in the use of lime, 47 in the use of fertilizers, 9 in the maintenance of humus, and 96 in drainage. In cooperation with the State food supply commission, power ditching machinery was operated in several counties under the farm bureaus. One hundred and thirty-two special farm visits were made, of which 96 were on account of drainage problems and involved assistance varying from a mere general indication of the location and construction of drains to comprehensive instrumental surveys with blue-printed maps. Instruction was given in 25 extension schools, with an attendance of 838.

Farm forestry.—Demonstrations are being conducted on 11 farm woodlots, 4 of which were established this year. Thirty-seven farm woodlots were visited and the owners advised as to their management.

Instruction in the relation of birds to agriculture.—Field trips were held with school-teachers for the purpose of instructing them in methods of teaching children how to recognize birds and the interesting points concerning the various species. Twenty-four lectures were given before teachers' meetings, granges, schools, bird clubs, and other organizations, with an attendance of 7,850. Ten articles on birds were published in the Rural School Leaflet.

Demonstrations in poultry industry.—Lectures and demonstrations were conducted under the local auspices of county farm-bureau organizations, rural schools, granges, farmers' clubs, Young Men's Christian Associations, poultry shows, and other organizations, and at extension schools and farmers' institutes. Four hundred and seventy-two meetings were held at 254 places, with a total attendance of 19,801. Exhibits were placed at State, county, and town fairs, poultry shows, and extension schools in 48 localities for an

aggregate of 190 days. Farm visits to train individual poultry raisers in proper methods of stock selection were made to 176 farms in 106 localities. Ten thousand one hundred and forty-five birds were selected, and pledges were given for the selection of 153,032 as the result of these demonstrations. Forty-one farms in Erie County were visited once a month in a cooperative effort with the county farm bureau to improve methods of production and to secure authentic records of flocks and poultry business management. Three specialists gave full time to this work and were assisted by 9 others for part time.

Extension work in landscape art.—The object of this project, which was inaugurated during the year, is to improve country life conditions, both of the home, school, and village, and to enhance the value of farm property by better arrangements of buildings and grounds and by more attractive plantings of trees, shrubs, and vines. The work consisted chiefly of preparing maps and planting plans based on personal surveys made. Two public playgrounds were planned, and surveys and plans were made for the improvement of two small towns, two State institutions, and two quasi-public institutions. In connection with these surveys, public lectures were usually given for the discussion of village improvement and the beautification of home grounds. Half of the time of one person is given to the project.

OTHER EXTENSION WORK.

Dairying.—The work of this project was carried on largely by visits to dairy plants and factories, 43 of which were visited during the year, and by giving instruction to students who have taken the winter course in dairy industry at the college. Building plans and suggestions for organization were furnished communities which plan to organize cooperative dairies. Six dairy plants were erected from such plans during the year.

Vegetable gardening.—Fifty-two field demonstrations for showing the best methods of cabbage culture, and 15 demonstrations of potato-seed selection were held. Work with beans was carried on by variety demonstrations with 14 cooperators and seed saving with 18 cooperators. One fertilizer demonstration was conducted. Considerable assistance was given to the campaign for home gardens and school gardening. Considerable time was given to a study of the dehydration of vegetables, and advice and assistance has been given to growers and those operating canning and dehydrating plants.

Exhibits at State, county, and town fairs.—Exhibits were made at the State fair, the Rochester industrial exposition, and at 12

county fairs. Lectures and demonstrations on the care and handling of poultry and killing and picking poultry were also conducted daily at the State fair, attended by over 2,000 persons. It is estimated that 170,000 persons were reached by these exhibits. Outside of the State fair these exhibits were placed only when the societies requested them and bore all the transportation expenses.

Lectures and lecture courses.—Members of the college staff gave 629 lectures in 49 different counties. These lectures were arranged only upon request from some local organization or groups through the county farm-bureau agent, and by the applicant paying half of the traveling expenses.

Miscellaneous field demonstrations.—These consist of field meetings arranged by the farm-bureau agents, where actual demonstrations are used, including seed-corn demonstrations, orchard pruning, spraying, poultry selection, fertilizer tests, and other demonstrations. These meetings were conducted mainly by the extension specialists, 21 members of the extension staff holding 463 demonstrations.

SURVEY.

As the county representatives of the State food supply commission the county-agent force directed the State's war program in agriculture. The promptness and completeness of the agricultural census for determining the agricultural situation and the subsequent work in locating seeds and labor, conducting a farmers' exchange service, and stimulating agricultural production, were the result of the excellent organization of the county agents and farm bureaus. The farm-bureau membership more than doubled during the year, and the organization of its work on a community basis makes it a truly democratic institution. The methods developed for organizing the control of insect pests and plant diseases, and for the cooperative operation of ditchers and tractors were made possible by well-established farm bureaus. The rapid organization of home-demonstration agent work as a war measure, and its remarkable achievement, were largely the result of the effective work of home-study clubs previously fostered by the extension service. The methods used for measuring the circulation reached by the very efficient press service are commendable as a means of determining the value of publicity material. The work in culling unprofitable poultry is a striking example of the possibility of applying the results of the most recent scientific research to the conservation of food as a war measure through the extension service. The projects of the extension specialists are being closely correlated with the work of the farm bureaus, and the war situation is facilitating a more rapid integration of the whole extension service, which has met the unusual demands upon it with fine spirit and with such success as to increase confidence in its leadership.

NORTH DAKOTA.

Division of Extension Work, North Dakota Agricultural College, Agricultural College.

THOMAS P. COOPER, *Director*.

Organization and administration.—There were no changes in the general organization, administrative policies, or relationships of the extension department during the year.

With the Nation's entrance into war, the attention of the entire staff was given to war problems affecting agriculture and the home. Campaigns were made in the early spring months to maintain the spring-wheat acreage, to plant gardens, to retain breeding stock on the farm, and to develop systems of living and farming that would meet the changed conditions confronting the country. Later campaigns were conducted to demonstrate the canning and drying of vegetables. The county agents participated in a labor survey and in many instances acted for the county for the distribution of farm labor. The results of the year indicated the place of the county agent in great national emergencies, as counties employing agents were organized most rapidly and effectively. The labor situation, machinery needs, seed requirements, feeds, and in many instances farm credits were taken care of promptly and effectively through the leadership of the county agent.

Publications.—Seven bulletins and 295,488 leaflets of from 1 to 4 pages were published. A farm information service furnished seasonable information relative to farm practice to 262 weeklies, 11 dailies, and 90 agricultural papers. Special articles were also prepared on request, one weekly having been furnished 24 articles.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal-----	\$21,453.18
Smith-Lever, State-----	11,453.18
United States Department of Agriculture, farmers' cooperative demonstration work-----	9,724.53
Bureau of Biological Survey-----	3,509.86
Bureau of Markets-----	250.00
State appropriations-----	22,589.44
County-----	26,957.72
Total -----	95,937.91

Smith-Lever funds were used in support of the following projects: County-agent work, home economics, boys' and girls' club work, farm-management demonstrations, and live-stock demonstrations. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, home economics, boys' and girls' club work, control of mammal pests, and marketing.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Counties with agents June 30, 1916, 15; June 30, 1917, 17, with 22 agents. The work was supervised by the extension director serving as county-agent leader.

Among the results of the activities during the year were the following: One thousand five hundred and forty-three farmers were assisted in testing seed corn for germination for 22,326 acres; 593 farmers treated their seed oats for smut as recommended, for 17,096 acres; 206 farmers treated their seed potatoes for the control of potato diseases, resulting in 1,680 acres of potatoes being planted with treated seed on suggestion of agents; the growing of more legumes was encouraged both for live-stock feeding and soil improvement, resulting in 675 farmers sowing 6,703 acres of alfalfa as recommended; 312 farmers raised 3,611 acres of sweet clover on suggestion of agents, and 398 farmers followed methods recommended and were induced to sow 17,905 acres of rye.

Considerable attention was given to live-stock improvement, resulting in the organization of 1 cow-testing association and 5 live-stock breeders' associations. Through these organizations and the help of the agents 28 registered stallions, 225 registered bulls, 141 registered cows, and 319 registered boars were secured, while 216 registered sires were transferred. Seven hundred and sixty-three animals were tested for tuberculosis and 4,601 animals were treated for blackleg, 77 silos were constructed, and 106 crop-rotation systems were planned and adopted at suggestion of agents. To increase the supply and improve the quality of hay and pasture, 3,630 acres of hay land and 4,253 acres of permanent pasture were top-dressed. Four hundred and twenty-nine farmers were induced to keep farm accounts. More than \$500,000 worth of business was done by cooperative buying and selling associations or farmers' exchanges, organized with the assistance of agents, resulting in \$27,850 being saved to the farmers. The agents conducted 1,988 demonstrations involving 438,554 acres of crops and 720 live stock.

In addition to the above work the agents gave assistance to farmers in securing or locating the following quantities of seed grain: Wheat, 20,717 bushels; oats, 11,915 bushels; barley, 3,209 bushels; and rye, 10,273 bushels. Through campaigns for increased crop production the wheat acreage was increased by nearly 100,000 acres and the production was increased 791,100 bushels; the oats acreage was increased by 13,290 acres and the production was increased by 181,800 bushels; the barley acreage was increased by 6,285 acres, increasing the production 51,700 bushels; the potato acreage was increased by

2,505 acres, increasing the production 89,350 bushels; and the rye acreage was increased by 88,500 acres. The agents assisted in placing 1,135 laborers on farms, in locating 2,811 horses for the War Department, and helped bring about an increase of 1,865 hogs and 4,728 sheep. Every agent helped organize Federal farm-loan associations. Assistance was given in organizing 81 of these associations with 1,887 members who requested loans amounting to more than \$7,000,000. One hundred and forty-one canning demonstrations were arranged for women; 764 persons received assistance in home gardening; and 1,422 farmers received information regarding storing fruit and vegetables.

The agents made 12,852 visits to farms, received 9,606 visits at their offices, and took part in 802 meetings, attended by 95,134 persons.

Home economics.—The permanent extension force previous to May 1, 1917, consisted of three women. In May one woman was added, and during July and August four additional women were employed. During the early part of the year the work centered around demonstrations and lectures on food, household equipment, household management, and community activities. In April an outline of the plans for the home-economics work was circulated throughout the State. The returns from this publicity made it possible for schedules to be arranged for 8 demonstrations for a period of 2½ months. A special force of 5 women gave 503 canning demonstrations with a total attendance of 42,231. As a result many individuals who had never previously canned food products for their home use took up the work. The drying campaign was especially successful in the southwestern section of the State.

Home-demonstration agent work was begun September 1, and 8 district agents were appointed. In order to bring about a system of work which will support the agent and form the basis for future organization on a county basis, councils were formed in the important centers of the State. These councils are advisory and are composed of representatives from women's organizations and also from unorganized groups.

There were no resident urban agents, but one extension worker was assigned to a circuit of the principal cities. In each city covered this agent organized home-economics teachers and other trained women into a corps of volunteers who supplemented her work by adopting a program for city work in home economics and giving a continuous course of demonstrations and lectures between the visits of the State-wide urban agent. Interest has been developed that will furnish a basis for resident urban agents. Special emergency campaigns were organized to demonstrate and encourage the canning and drying of vegetables to develop a greater reliance upon home-

produced foodstuffs and to increase public interest in the conservation of food.

Boys' and girls' club work.—In the six projects which were completed 40 club groups were organized, with a total enrollment of 3,794 members. Products valued at \$6,419.98 were reported produced at a total cost of \$3,256.41. The club leaders conducted during the year 101 canning demonstrations, with a total attendance of 3,730 club members, women and men. In addition 33 field demonstrations and 43 local and county club exhibits were conducted. Two thousand two hundred and sixty-two club plats were visited during the year and 69,415 copies of club literature were distributed by the State to club members. The work was in charge of a State leader and three assistant leaders paid cooperatively by the State agricultural college and the department; 45 unpaid volunteer leaders assisted in the work in their respective communities, and were responsible for 50 per cent of the results in the work.

In previous years the boys' and girls' club work was largely carried on through individual enrollment, but this year increased emphasis was given to membership in local clubs in order better to promote types of work that teach habits of thrift, industry, helpfulness, and interest in agriculture and the home. This method of club organization gave greater assistance to each boy and girl and created a greater enthusiasm than did the individual enrollment. It also brought about a greater opportunity for community organization along particular agricultural lines as emphasized by the club work.

The following table gives some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	3	242	58 acres.....	894 bushels.....	\$2,018.11	\$834.71
Potato.....	17	132	16 acres.....	1,568 bushels.....	1,657.86	895.48
Poultry.....	2	21	338 fowls.....	401 chicks.....	232.71	91.30
Pork and crop.....	1	25	46 pigs.....	9,256 pounds.....	1,425.45	826.45
Canning.....	8	116	.....	1,365 quarts, 16 glasses jelly.....	686.70	325.47
Garment making.....	9	156	.....	875 garments.....	399.15	283.00
Total.....	40	692	.....	.....	6,419.98	3,256.41

Total club enrollment, 3,794.

Farm-management demonstrations.—During the year the county agents in 16 counties assisted farmers to study their business. Four hundred and twenty-nine farmers started keeping accounts. Farm-analysis records were taken on 71 farms.

Live-stock demonstrations.—Extension work with live stock was conducted along three principal lines: Lectures and demonstrations upon methods of feeding, live-stock management and its place on the farm; the control and prevention of live-stock diseases; and the management of farm poultry. These discussions included the importance of the growth of forage crops and the economic importance of live stock in farm management. As a result of the work the State seems to have come to a realization of the possibilities and advantages of live-stock production, and a marked increase in the number of breeding stock is apparent. A specialist was employed to give instruction on the prevention and control of live-stock diseases. Forty-nine demonstrations and lectures were given, with an attendance of 3,136. In addition to the prevention of the more common diseases, the question of sanitation and methods of keeping farms free from disease was stressed.

OTHER EXTENSION WORK.

Horticulture.—The work of this project consisted of lectures and demonstrations on vegetable growing as adapted to farm conditions, on fruit growing, on windbreaks, and on landscaping as applied to the farmstead and the beautification of grounds. Four 1-day potato demonstrations were held to show the proper selection and treatment of seed potatoes to insure freedom from disease.

Rodent extermination.—The work in the extermination of ground squirrels continued on a large scale. It was organized by the county agents through the local township officials in 17 counties. Approximately 19,000 farmers took part in a poisoning campaign, covering 7,606,960 acres. Thirteen thousand ounces of strychnine were used in the preparation of the poisoned bait at a cost of $3\frac{1}{2}$ cents per acre. In the well-organized counties reports show that 85 per cent of the ground squirrels were killed. Estimates show that under ordinary conditions they cause an average loss of \$89 per quarter section of crops, for which area poisoned bait costs 80 to 90 cents. In the western part of the State campaigns were carried on in the destruction of prairie dogs. This work is in cooperation with the Biological Survey, United States Department of Agriculture.

SURVEY.

War conditions have shown the need and value of local organization as a means of successful extension work and the large place of leadership which the county agents have attained. The extensive campaign in poisoning ground squirrels is a fine example of organized cooperative effort under expert leadership. The larger emphasis upon volunteer leadership of local boys' and girls' clubs has

yielded very tangible results, has given greater zest to the work, and supports the gradual development of community organization. The extension work with live stock is commencing to yield results, and farmers are appreciating the need of a more diversified agriculture.

OHIO.

Division of Agricultural Extension Work, College of Agriculture, Ohio State University, Columbus.

C. S. WHEELER, *Director*.

Organization and administration.—The most notable change in the organization of the extension work was in placing the extension specialists in the subject-matter departments of the college instead of in a separate division of the extension service. As now organized the extension service of the college of agriculture consists of five bureaus, the office of the secretary, and a group of specialists responsible jointly to the teaching departments of the college and to the extension service. The five bureaus, each of which is under the direction of a responsible head, are: County-agent work, publications and correspondence courses, home economics, farmers' institutes and extension schools, and boys' and girls' club work. During the year the college of agriculture continued to extend its teachings throughout the State by the further development of the several lines of work which had previously been carried on. Only slight changes in the general plan of the activities were made.

Pursuant to the action of the legislature the boys' corn-growing contests on March 6 were transferred from the State board of agriculture to the State university. These contests were made a part of the extensive boys' and girls' club work already being conducted by the college of agriculture. The loss caused by epidemics of hog cholera made it seem desirable to carry on some educational work dealing with methods of checking that and other diseases of animals. Accordingly the university entered into a cooperative arrangement with the State board of agriculture and the Bureau of Animal Industry of the United States Department of Agriculture. Under this arrangement the university and the Department of Agriculture employed a specialist in veterinary science and began, through county agents and otherwise, to carry on educational work.

This work has been greatly aided by the cooperation between the college of agriculture, the agricultural experiment station, and the board of agriculture. This useful voluntary cooperation will hereafter have the added advantage of official recognition. An act passed by the last legislature created an agricultural advisory board, whose members are the governor, the dean of the college of agriculture, the

director of the agricultural experiment station, and the secretary of the State board of agriculture. These officers, meeting monthly, will, no doubt, be able to coordinate further the activities of the three institutions.

A new and profitable opportunity to cooperate has been developed in the relations recently established with the State industrial commission in the matter of its employment offices. Recent acute shortage of farm labor suggested the establishment by the college of agriculture of an organization having the character of employment offices. The same situation brought to the attention of those in charge of employment offices maintained by the industrial commission the desirability of having men traveling about the several counties and closely in touch with farmers. The results desired by both institutions were accomplished when close cooperation was established between those in charge of the several employment offices throughout the State and the county agricultural agents representing the university. Though this cooperation came about through an emergency connected with the war, it seems likely that it may be continued indefinitely, and probably improved.

Upon the creation of the Ohio branch of the National Council of Defense an agricultural division was appointed, of which the president of the university was chosen as chairman, and the director of extension as executive secretary. Other members were the dean of the college of agriculture, the agronomist of the experiment station, and the master of the State grange. The staff was largely drawn from the college of agriculture. The immediate problems were acreage of spring crops, farm labor, seed stocks, transportation, and marketing. In dealing with these problems, the existing agencies of the extension service were utilized, and three new bureaus of student labor, public meetings, and city gardening were created.

The inauguration of the emergency movement found 22 counties in the State supplied with county agricultural agents working under the direction of the college of agriculture. In order to give every county in the State the services of a trained agricultural worker, devoting his whole time to the work, 30 special agents were furnished temporarily. These men volunteered for the service. The Ohio Agricultural Experiment Station, the board of agriculture, and the college of agriculture donated their time, continuing their salaries, and in some cases their travel expenses. Each of the 30 men added was assigned to a district consisting of from one to three counties, in such manner as to cover the State. The work of the county agents and the special agricultural agents was adjusted to meet the most urgent needs along the following lines: (1) Getting labor for immediate use, (2) making arrangements for harvest labor, (3) giving

information regarding seed, (3) rendering assistance in having car-load shipments of agricultural supplies moved.

Publications.—Twelve bulletins, with a total of 288 pages and a total edition of 435,000 copies, and 57 circulars with a total of 388 pages and a total edition of 391,000 copies, were published during the year. The Ohio Farm Bureau Monthly, a four-page, letter-size folder, was published monthly in an edition of 6,000 copies. It pertains wholly to the work of the extension service. A biweekly news letter was duplicated and sent to the newspapers of the State, 80 per cent of which published the matter fairly regularly. Three hundred and twenty-five exclusive news articles were furnished to the local papers of the State. Announcements of extension activities were distributed to the local papers in the form of plate matter, 2,063 columns of which were furnished. The mailing list consisted of about 35,000 names on stencils, so classified that only bulletins on subjects indicated by the applicant were mailed.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal -----	\$56,852.14
Smith-Lever, State -----	46,852.14
United States Department of Agriculture, farmers' cooperative demonstration work -----	13,214.47
Bureau of Animal Industry -----	1,500.00
State appropriations -----	62,420.82
County -----	19,772.34
Total -----	200,611.91

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, farm-management demonstrations, extension schools, soils and crops, horticulture, animal husbandry, poultry husbandry, rural engineering, control of animal diseases, and dairying. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, home economics, boys' and girls' club work, farm-management demonstrations, and dairying.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents June 30, 1916, 12; June 30, 1917, 20. Work was supervised by the county-agent leader.

The principal results of the work during 1917 were the following: Two thousand two hundred and fifty-three farmers selected seed corn

in the fall, resulting in 29,965 additional acres being planted with fall-selected seed, and 1,511 farmers tested their seed corn for germination at suggestion of agents, resulting in 25,570 additional acres being planted with tested seed; 1,945 farmers treated their seed oats for smut and 24,024 additional acres were sown with treated seed. The growing of more legumes was encouraged, resulting in 478 farmers sowing 2,625 acres of alfalfa, and 340 farmers sowing 4,093 acres of soy beans. Three hundred and thirty-five farmers followed suggestions of agents in caring for their orchards containing 69,050 trees. In order to bring about the use of better stock 5 live-stock breeders' associations and 15 cow-testing associations were organized with the assistance of agents; 5,454 cows were under test, resulting in 890 being eliminated as unprofitable, and 254 farmers adopted balanced rations recommended for their herds; 36,927 hogs were vaccinated for cholera by veterinarians or farmers at suggestion of agents.

Considerable attention was given to soil improvement, resulting in 82 drainage systems being planned and installed, involving the drainage of 3,514 acres. The agents tested soil for acidity on 798 farms, helped to introduce 5 limestone crushers, brought about the use of 8,364 additional tons of lime, and 927 farmers used 6,174 tons of chemical fertilizers. Farm-analysis records were taken by agents on 429 farms, and 398 farmers were induced to keep farm accounts. Fifteen cooperative buying and selling associations, organized with the assistance of agents, did more than \$500,000 worth of business, saving \$45,560 to the farmers. The agents conducted 1,240 demonstrations, involving 29,939 acres of crops and 1,992 live stock.

Shortly after the declaration of war emergency agents were placed in all parts of the State, each covering an average of two counties. The faculty of the college of agriculture, specialists of the Ohio Experiment Station, and employees from the State department of agriculture were assigned to do this emergency work, which consisted largely of rendering assistance in securing farm labor, adequate seed supply, and organizing boys' and girls' clubs. The work of these emergency agents was discontinued June 30, 1917.

As a result of campaigns conducted by the regular and emergency agents to increase crop and live-stock production to meet the war needs, 2,375 farmers were assisted in securing or locating 15,753 bushels of seed potatoes; 9,599 additional acres of corn were raised, increasing the production 259,250 bushels; and 3,330 additional acres of potatoes were raised, increasing the production 134,600 bushels. Through these campaigns the bean acreage was increased by 1,104 acres and the wheat acreage by more than 12,000 acres; 2,601 farmers were assisted in securing or locating 8,415 tons of chemical fertilizers. The agents assisted in establishing 9 public markets, which did more than \$1,000,000 worth of business. They also assisted in organizing

8 farm-loan associations. Assistance in home gardening was given 7,729 persons, 1,278 farmers were given information in regard to storing fruit and vegetables, and 113 canning demonstrations were conducted for women, resulting in 82,260 additional quarts of fruit and vegetables being canned.

In doing their work the agents made 9,804 visits to farms, received 20,153 callers at their offices, and took part in 2,367 meetings, attended by 184,693 persons. In all counties having agents farm bureaus were organized, with a membership of at least 10 per cent of the farmers of the county. The total farm-bureau membership in the State was 10,077.

Home economics.—The State-wide extension staff consists of the supervisor, who is head of the home-economics department, the assistant supervisor, and 10 instructors. The staff was increased during the three winter months by eight extra workers, and part of the time by a trained nurse of the District Nursing Association of Columbus, who gave valuable talks and individual instruction on the care of children. Thirty-five 5-day extension schools, with an average attendance of 40 (total attendance, 1,400), were given in connection with agricultural extension schools. These extension schools followed a 2-year program on foods, household management, and dress. An interesting type of extension school was conducted in connection with the county normal schools, where village and rural teachers are trained; 45 of these 5-day schools were held with an attendance of 630 prospective teachers. The purpose of these schools was to stimulate interest in introducing school luncheons and to teach the necessary facts about foods needed, by leaders of boys' and girls' club work. One instructor was assigned to special duty in initiating and guiding the school-lunch work in new communities, and eighteen 5-page circulars, or lesson plans, were prepared for the use of teachers who were conducting such lunches. Some attention to school lunches was given in 61 counties, an increase of 43 counties during the year. There were 140 women's clubs on the mailing list for suggestive programs along the lines of food, care of children, and household management. Sixty-five of these were members of the Ohio Farm Women's Federation. Eighty-six new communities requested assistance in organizing clubs, and 60 clubs were visited. All of these clubs have given valuable cooperation in the campaign for the preservation and the conservation of food. Eight hundred and eighty-six women attended the home-economics sessions during Farmers' Week. One instructor was assigned to a 6-months' study of the social and economic needs of the farm women in Montgomery County. She was appointed State leader of rural home-demonstration agents September 1, 1917, and by December 17 home-demonstration agents had been placed in 7 counties as a part of the farm-bureau organizations.

The State leader of the home-economics project made the new extension work in cities one of the particular problems of the year, and the work with cities made good progress. Four urban home-demonstration agents were appointed before January 1, 1918. This work was forwarded by securing the cooperation of many existing organizations, including the home-economics department of the university, colleges, schools, women's clubs, the municipal government, and business men. Trained women of the State were registered for volunteer service. The city work was developed with a recognition of the fact that the chief function of an urban home-demonstration agent is to organize, serve, and coordinate the home-economics interests of the city in such a way as to further the purpose of the Government under the war emergency.

-Boys' and girls' club work.—The club work in agriculture and home economics was supervised by a State leader and an assistant club leader, paid cooperatively by the State and department; 650 local volunteer leaders assisted in conducting clubs in various communities throughout the State and secured practically all of the new enrollment. The work was conducted in cooperation with the county and district school superintendents and the county agricultural societies, and the local clubs were largely organized by the school superintendents.

Six hundred and thirty-seven clubs were organized, with a total enrollment of 10,635 members. In the six club projects completed, 2,234 club members reported products to the value of \$95,703.26, at a total production cost of \$34,437.09. During the year 49 club fairs and festivals were conducted and 220,000 copies of club literature were sent to members to assist them in their work. Two hundred canning demonstrations were given in 42 counties, with an attendance of 5,000.

As a reward for the successful completion of a club project, 3 boys or girls from each county, 186 in all, received a free trip to Farmers' Week at the expense of the university, and special programs were arranged for them. Five county prizes were also awarded on the best record made by the 3 boys from each county. During the year the junior contests of the State board of agriculture were transferred to the university, involving the fulfilling of obligations made by the board and a consequent revision of contest rules. This also involved the management of the annual trip of several hundred county contest winners to Washington and other eastern cities. This trip has been conducted for several years by the State board of agriculture with funds raised by local subscriptions.

The following table shows some of the more important results of the club works:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	.....	723	723 acres.....	61,455 bushels..	\$67,600.50	\$19,139.00
Potato.....	55	209	21 acres.....	3,477 bushels..	5,170.20	2,342.89
Tomato.....	23	101	404 square rods.....	.....	2,541.16	901.36
Pig.....	86	339	456 pigs.....	73,416 pounds..	12,847.80	7,231.48
Canning.....	268	546	.....	17,006 quarts, 8,736 glasses jelly.	6,043.60	4,343.09
Garment.....	116	316	.....	1,053 garments	1,500.00	479.36
Total.....	548	2,234	.....	.....	95,703.26	34,437.09

Total club enrollment, 10,635.

Farm-management demonstrations.—The farm-management demonstrators conducted the work, which was begun in 10 counties, making a total of 19 counties conducting the work. Five hundred and fifty-nine farmers were assisted by county agents and the farm-management demonstrators in studying their business through simple farm accounts. Farm-analysis records were taken on 324 farms. These and 233 records taken the preceding year were summarized, returned, and personally discussed with the farmers. As a result of farm-management demonstration work, 133 farmers changed the management of their business in order to increase their labor incomes.

Extension schools.—Thirty-six extension schools were held in as many counties of the State, under the same general policy as in previous years. Each school continued for five days and included separate sessions for men and women. At each of the men's sessions a course was given in soils and crops, a course in dairying, animal husbandry, or horticulture at the election of the people, and special lectures on poultry husbandry or rural engineering. The average daily attendance was 75—33 men and 42 women—the total attendance being 27,090.

Soils and crops.—During four winter months the time of 3 men was devoted to instruction in extension schools. Seventy-five fertility meetings were held on farms with an attendance of 1,060. At each meeting the instructor made an examination of soil and crop conditions on the farm, and samples of soil from it and near-by farms were tested for acidity. The instructor then discussed the soils and crops problems of the farm and locality. An increasing amount of work of this sort has been done in cooperation with county agents. Sixty-five samples of limestone and marl were tested for neutralizing

power, 157 samples of soil were tested for acidity, and suggestions were given for their management. The correspondence relative to soils increased rapidly during the year. The work in crops was conducted in close cooperation with the specialists in soil fertility. Thirteen demonstrations in methods of selecting and storing seed corn were held with an attendance of 103. Demonstrations were also held in germinating seed corn, and a 10-acre corn contest for men was supervised. One hundred field demonstrations were given of better varieties or improved strains of wheat, attended by 180. Demonstrations of the treatment of oats for smut and of the introduction of better varieties or improved strains were held at 71 places with an attendance of 1,039. Twenty demonstrations of the treatment of potatoes for scab, were attended by 340. Five demonstrations of tobacco-bed sterilization were made. Field meetings at demonstrations of the introduction of soy beans for hay and for seed were also held. Six grain shows, attended by 610 persons, were judged, and the exhibits used for demonstrating the difference between good and inferior seed. Seven community meetings, attended by 330, were held for discussing farm-crop problems, and 80 meetings, attended by 1,000, were held with boys' corn clubs. The four winter months were devoted to instruction in extension schools. Two weeks were spent in assisting county agents to write projects in farm crops.

Horticulture.—There were 175 demonstrations in pruning and spraying, 25 in thinning fruit, and 5 in grading and packing peaches, attended by 3,300 people. In four counties there were all-year demonstrations in pruning and spraying. Demonstrations were made at six fruit and vegetable shows. Two winter months were occupied with instruction at extension schools. Thirty lectures were also given to a total of 2,600 people. In the city-garden work, 13 garden specialists worked with civic bodies, workmen at factories, and schools, thus reaching 20,000 people. The landscape work included illustrated lectures, visits to rural schools, churches, and public libraries and the furnishing of planting plans to 55 rural schools, 3 churches, and 1 public library.

Animal husbandry.—Three months were spent in extension-school work. During the year 262 pig-club meetings were attended and 400 pig-club members were visited personally. Twenty-eight pig-feeding contests at county and local fairs were conducted. Eighteen live-stock judging contests, other than club work, were held. Assistance in the organization of two pure-bred live-stock associations was given. Seven successful steer-feeding demonstrations and four hog-feeding demonstrations were made. Several live-stock shows were judged. The county agents were assisted in arranging their projects covering animal-husbandry work.

Poultry husbandry.—Twenty-two poultry demonstrations were given on farms including the fattening of poultry for market, caponizing, the selection of breeding stock, and treatment of poultry diseases. The total attendance was 370. Recognizing that fully 90 per cent of the poultry product of the State is from farm flocks, special effort was made to bring to the attention of farmers the results secured by proper handling of typical flocks. For this purpose a number of flocks in Montgomery County are being used as poultry demonstrations for their respective communities. An educational exhibit was made at nine poultry shows and four fairs. An instructor accompanied this exhibit and thus had opportunity to give personal advice to thousands of poultry men. Where the exhibit has been made several years, interest in it has increased, and it is felt to be a very efficient method of presenting information. Ninety farm visits were made for giving assistance in planning plants or advising as to poultry management. Fifty-four poultry-association meetings were held, attended by 1,844. A series of educational meetings was held during 5 winter months with six local poultry associations. The specialist visited each association once a month and thus had opportunity to become intimately acquainted with its problems and to give the instruction a more local application. The average attendance at these meetings was 35. One day's instruction was given at each of 24 extension schools. Ninety meetings of boys' and girls' clubs were attended at which 1,188 were instructed.

Agricultural engineering.—Two men gave their entire time to this project. Farm sewage-disposal demonstrations were continued, 24 being held to show the construction of septic tanks. As a result of the number of tanks built a standard type of septic tank has been developed, and the work now requires less attention. Fifty-two drainage demonstrations were held in 15 counties, and 360 men were advised individually concerning farm drainage. Drainage systems were laid out for 2,400 acres. In farm building and farmstead demonstrations 75 visits were made to farms, and interviews were held with 370 farmers individually regarding their farm-building problems. Work in farm-structure demonstrations was started during the year. Considerable time has been given to the preparation of some 40 stock plans of farm structures. Thirty-five demonstrations were held to show the best methods of bringing water into the farmhouse. As a result of the success of the few farm-lighting demonstrations, more of them will be held. One thousand and seventy persons attended the demonstrations held on 186 farms, and 5,500 were instructed at extension schools and other meetings.

Control of animal diseases.—This work was confined principally to the control of hog cholera, and was in cooperation with the Bureau of

Animal Industry, United States Department of Agriculture, and the State board of agriculture. Special effort was made to control the disease in selected areas comprising 6 counties. Hog-cholera associations were organized in 25 townships. Eighty-six owners of cholera-infected herds were visited and advised as to methods of control. Three hundred and sixty-two neighbors of infected farms were visited and warned of the presence of the disease. Some attention has been given the prevention and eradication of contagious abortion of cattle, and it is expected to give more time to its control. Interviews were held with 76 local veterinarians.

Dairying.—Supervision was given 30 cow-testing associations, involving 751 herds of 10,297 cows. Of these associations, 9 were newly organized and 21 were reorganized. One cooperative bull association was organized, the first and only one in the State. The field agent took part in 60 meetings, 20 of which were in counties with county agents. This project is in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture.

OTHER EXTENSION WORK.

Farmers' institutes.—The 1916-17 farmers' institute season opened November 13, 1916, and closed February 23, 1917. Between these dates 423 regular 2-day institutes of 5 sessions each were held. In no case were more than 5 State institutes, as provided by law, held in any one county. In this work 30 practical farmers of the State and 7 qualified farm women, from the staff of the Ohio Agricultural Experiment Station, and 1 woman and 1 man from the college of agriculture were employed. The average attendance per session of the 2,115 sessions held was 196. The total attendance for all sessions was 415,185—a slight increase over that of the previous year. The per capita cost for those in attendance was 7.8 cents.

Independent institutes are those held independent of State aid. Every encouragement and assistance possible was given to institutes of this class. Reports were received from 96 independent institutes—an increase of 44 per cent over the number of the previous year. The total attendance reported is 86,050. This number, added to the attendance of the regular institutes, makes a total attendance at Ohio institutes the past season of 501,235—a figure significant of the power and possibilities of the institute organization.

Conforming to a desire to enlarge the scope of the institutes and reach and strengthen the various phases of community life, 14 men were employed who had been active in community service. Each was qualified by experience to give instruction on and awaken interest in the subject of community betterment. After a conference at the university, which served to unify ideas and ideals, one of these men was scheduled to each of the State institutes, with the result that

thousands of rural people caught the vision of a richer rural life. Numerous projects are now under way for the betterment of rural conditions.

Correspondence courses.—The total number of persons enrolled in correspondence courses on May 31, 1917, was 8,333, an increase of 1,833 during the year. Since July 1, 1916, 17,324 lessons have been mailed to students in 13 different courses. A survey made in November, 1916, of the first 4,200 students enrolled showed that 32 per cent had completed the course. Prior to this time no follow-up work was done. Fifty per cent of the men and 64 per cent of the women enrolled were engaged in agricultural occupations. Each county agent is furnished a list of all students in his county, so that he may render them any assistance possible, and they are urged to call on him as necessary.

SURVEY.

Making the extension specialists members of the subject-matter departments of the college should result in increased efficiency and a larger interest in extension work by all members of the college staff. The transfer of all boys' and girls' club work to the extension division by the State department of agriculture and the cordial cooperation of the two organizations gives new strength to the extension work. The creation of the State agricultural advisory board should be the means of better correlation of the agricultural forces of the State. The fine service which the extension service rendered the State council of defense, and the support of the council in placing special agents in the unorganized counties, gave the State an efficient force for meeting the agricultural problems of the war emergency. The well-organized work in the betterment of school lunches was an outstanding achievement in home economics. The success of the work of farm women's clubs indicates that they have a real sphere of usefulness in extension work. The poultry specialist is developing a new method of extension work with local poultry associations which has large promise. The use of the demonstration method in the work in agricultural engineering will be found to be the best means of creating and radiating public opinion in this as in other fields of extension work.

OREGON.

Division of Extension Work, Oregon State Agricultural College, *Corvallis*.

R. D. HETZEL, *Director* (Resigned September, 1917).

O. D. CENTER, *Director* (Appointed September, 1917).

Organization and administration.—No material changes were made in the general organization or policies of administration, dur-

ing the year. Regular weekly conferences of the extension staff have added much both to efficiency and enthusiasm. The happenings and developments of the week were presented, and such instructions and announcements as necessary were given by the director. All members of the staff joined in the discussions and presented summaries of their work. Minutes of the conferences were kept and sent to all extension workers, including the county agents. The war emergency resulted in diverting attention from some of the work in progress or planned to other lines of work brought forward by the Nation's immediate needs.

Publications.—Ninety-one regular extension publications were issued during the year, aggregating a total of 490 pages and with a total edition of 412,000. Of this number 49 were devoted to boys' and girls' club work, 13 to horticultural subjects, and 9 to home economics. Three reprints with a total of 60 pages and an edition of 9,000, and 3 emergency leaflets with a total edition of 22,000, were also issued. Nine issues of the Extension News, which is devoted to items of timely interest connected with extension work, were published. The extension service conducts a press bureau for the whole institution, and during the year contributed over 2,000 articles, stories, and items to local and agricultural papers and magazines.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$18, 151. 66
Smith-Lever, State	8, 151. 66
United States Department of Agriculture, farmers' co-operative demonstration work.....	10, 328. 43
Bureau of Biological Survey.....	2, 650. 00
Bureau of Markets.....	1, 250. 00
Bureau of Animal Husbandry.....	5, 124. 38
State appropriations	54, 543. 32
County	22, 406. 74
Other sources within the State.....	1, 224. 66
Total	123, 830. 85

Smith-Lever funds were used in support of the following projects: Administration, home economics, boys' and girls' club work, extension schools, and extension specialists. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, boys' and girls' club work, farm-management demonstrations, rural organization and marketing, dairying, and control of mammal pests.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

Home economics.—The following major projects were conducted during the past year: Home cooperator's demonstration project, farm home-study tour, food preservation, and emergency work. In co-operation with the county agent, three counties were organized for the home cooperator's demonstration project. Cooperative centers were established and the State leader spent 4 weeks in Josephine, Jackson, and Yamhill Counties, meeting with the women and presenting the subject matter on household accounting, food for the family, home canning and jelly making, kitchen equipment, and choosing of textiles. As a result, 300 women signed as cooperators to carry out specific demonstrations in their homes. Later the home-demonstration agents carried this work to completion in their districts. In April the first farm home-study tour was made in Yamhill County. One hundred farm women and men made a tour of two days and covered 100 miles of territory. The farm homes visited were studied for general arrangement of the rooms for convenience, water and lighting systems, equipment, kitchen arrangement, and landscape gardening. Short talks were given at each stop. Each day a demonstration in canning was given. A request was made by members who joined the tour for a larger and more extensive tour for next year. A special campaign of five weeks for food conservation was carried out in the spring. The principal centers in 16 counties were visited by the food preparedness train, with an estimated attendance of 14,325 people. Two months were devoted to follow-up work after this campaign, in which 50 communities were reached. In one county 25 home driers were constructed. A special training course was given for volunteer leaders and home-demonstration agents. In August, seven district home-demonstration agents were appointed and assigned to 18 counties. An assistant leader was added to the State staff. The new agents appointed community committees and laid the foundation for permanent county organizations. Conservation lectures were given before 15 county teachers' institutes, reaching 2,250 Oregon teachers. The agents also assisted in the Government food surveys and the pledge-card campaign.

Boys' and girls' club work.—The work of the boys' and girls' clubs was conducted by a State leader and two assistant club leaders, paid cooperatively by the State and department on entire time, and five cooperatively paid leaders on part time. There were also 100 unpaid volunteer leaders assisting in the work in their respective communities.

During the year the club leaders conducted 128 canning demonstrations, with a total attendance of 10,657 members—men, women, and children—370 field demonstrations, 19 club fairs and festivals, and 33

local county, district, and State exhibits were held. Six hundred and forty-two club plats were visited during the year and 163,000 copies of follow-up instructions were prepared in the State and sent to club members. In the 11 projects reported there was an enrollment of 9,120 club members, who reported products to the value of \$31,847.39, produced at a total cost of production of \$13,838.99. Ninety per cent of the club groups and 90 per cent of the members enrolled were club members in the year 1916.

Four projects, dairy herd record keeping, farm and home handicraft, rural-home beautification, and the agricultural club, were confined to persons from 19 to 21 years of age, and had a membership of about 900.

As a special war-emergency program the entire State was organized for food production and food conservation through gardening work. Reports of this work were received from 61 cities and towns, reporting 8,792 gardens producing vegetables for family use, valued at \$175,800, which is positive achievement in a war program.

The following table gives some of the more important results of the club work:

Summary of complete projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Products.		
				Amount.	Estimated value.	Estimated cost.
Corn.....		51	24 acres.....	1,394 bushels.....	\$2,243.53	\$502.76
Potato.....		65	10 acres.....	2,682 bushels.....	2,599.44	911.39
Home garden.....		104	1,210 square rods.....		3,070.53	1,252.16
Agricultural.....		5	5½ acres.....		928.90	361.20
Poultry.....		107	346 fowls.....	2,167 chicks.....	2,600.52	1,004.54
Pork and crop.....		170	447 pigs.....	76,371 pounds.....	11,883.80	5,965.78
Dairy.....		8	18 cows.....		1,931.30	681.70
Canning.....		179		10,229 quarts; 1,746 jelly.	3,422.60	1,623.80
Bread.....		164		7,943 loaves.....	794.30	635.44
Garment.....		303		1,905 garments.....	1,992.47	773.00
Handicraft.....		41		193 pieces.....	380.00	121.22
Total.....		1,197			31,847.39	13,838.99

Total club enrollment, 9,120.

Extension schools.—Five regular extension schools were held, with a total attendance of 3,335. Extension schools carrying several subjects through four or five days had not proven satisfactory, and a particular day was given to each subject. This made it possible to route the specialists giving instruction from one school to another, and enabled a farmer to attend on those days when subjects were discussed which were of particular interest to him. An effort was also made to use the laboratory method by having the people take part in the demonstrations held as far as is possible.

OTHER EXTENSION WORK.

County-agent work.—Number of counties with agents, June 30, 1916, 13; June 30, 1917, 14. The work was supervised by the county agent leader and one assistant. Twelve assistant county agents were used to assist the regular agents. Five district agents, covering 12 counties, were used to stimulate food production in counties without regular agents. The plan of organization formerly used in the State has been modified so as to provide for community committees.

Among the results of the work during 1917 were the following: Three hundred and forty-six farmers tested their seed corn at the suggestion of agents, for 1,545 acres; 287 farmers treated their seed oats for smut, for 4,147 acres; and 654 farmers were induced to treat their seed potatoes for the control of potato diseases, resulting in 4,077 acres being planted with treated seed. Considerable attention was given to live-stock improvement, resulting in 9 cow-testing associations and 6 live-stock breeders' associations being organized; 4,397 cows were brought under test, resulting in 178 cows being discarded as unprofitable. Through these associations and the work of the agents, 106 registered bulls and 176 registered cows were secured, and 111 farmers adopted balanced rations for their herds. A special effort was made to demonstrate the control of live-stock diseases, resulting in 8,821 animals being tested for tuberculosis and 6,199 animals being treated for blackleg at suggestion of agents. The use of silos was recommended, resulting in 303 additional silos being built. Forty-one drainage systems and 13 irrigation systems were planned and installed, respectively, draining 24,495 acres and irrigating 8,620 acres. Four hundred and fifteen farmers were induced to keep farm accounts. Through buying and selling associations and farmers exchanges organized with the assistance of agents, a business of \$320,000 was done, saving \$21,000 to the farmers. The agents conducted 332 demonstrations, involving 123,639 acres of crops and 2,482 live stock. The demonstrations affecting the largest acreage were those held for the control of ground squirrels. As a result of this work, carried on in cooperation with the Bureau of Biological Survey, several hundred thousand squirrels were poisoned, saving several thousand bushels of grain.

In addition to the above, the agents did work to help increase crop and live-stock production to meet the war needs. They located or secured for farmers 17,885 bushels of seed wheat, 7,800 bushels of seed barley, 4,340 bushels of seed potatoes, and 2,230 bushels of seed beans. The campaigns for crop production resulted in 19,325 additional acres of wheat being raised, increasing the production more than 100,000 bushels; 19,512 additional acres of oats were produced, increasing the production nearly one-third of a million bushels; 5,515 additional acres of potatoes were planted, increasing the pro-

duction 224,700 bushels; and 5,694 additional acres of beans were raised, increasing the production 34,342 bushels. Eight hundred and fifty-nine applications were received for farm help at the county-agents' offices, and 488 laborers were supplied. The agents were influential in having 3,200 additional sheep placed on farms. They also helped to locate 953 horses for the War Department. Assistance was given in the organization of 27 farm-loan associations. Fifty-seven canning demonstrations were arranged for women, resulting in 111,800 additional quarts of vegetables and fruit being canned.

The agents made 5,853 visits to farms, gave information to 11,680 persons at their offices, and held 1,154 meetings, attended by 48,281 persons.

Farm-management demonstrations.—During the year work was conducted in two additional counties, making a total of 11 which carried on farm-management demonstration work. The greater part of the time of the farm-management demonstrator was devoted to teaching farmers how to study their business. After the resignation of the demonstrator, on June 30, 1917, the county agents carried on the demonstration work without a leader. Five hundred and seventy-six farmers were assisted by county agents and the demonstrator to keep farm records of their business. Farm-analysis records were taken on 80 farms. These and 93 records taken the previous year were summarized, returned, and personally discussed with the farmers.

Horticulture.—Seven spraying demonstrations were conducted in 8 orchards, 3 for the brown rot of prunes, 3 for the control of apple scab, codling moth, and apple aphid, and 1 for the control of peach-leaf curl. Five pruning schools and 12 one-day pruning demonstrations were held during the year, at which 1,238 orchardists were in attendance and took part. The specialist judged fruit at 11 fairs, attended 149 meetings, and visited 153 farms during the year. Some seed-potato certification work was done on 49 farms growing 700 acres of potatoes.

Dairying.—Nineteen demonstrations on the compounding of rations were given during the year. Cattle were judged at 12 fairs before 1,750 people. Four butter and cheese scoring demonstrations were conducted. Fifty-three visits were made to creameries and 25 conferences held with boards of directors. The outstanding results in the creamery advisory work include: Organization of the Oregon cooperative-dairy exchange; cooperative marketing by exchange members through their own Portland house; removal of discrimination against country-made butter and the opportunity to market it on a quality basis, which made possible an increase of 3 cents a pound on all butter grading as extras and saved country creameries about \$100,000; and general adoption of cream grading by country creameries. Supervision was given 17 active cow-testing associations, involving 420 herds of 7,782 cows. Two new associations were formed.

Eighteen silos were erected, and 50 farmers were furnished silo plans. Twenty-nine pure-bred Guernseys were purchased and brought to the State, and 7 pure-bred bulls were purchased for association members. This project is in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture.

Plant pathology.—Five field assistants held 80 demonstrations for the control of oat smut, attended by 737 farmers. They also visited and assisted 2,656 additional farmers in seed treatment. A crop-disease survey, with a campaign for disease control was carried on.

Veterinary service.—About 100 cases of parasitic infection and noninfectious diseases were diagnosed and handled. Over 1,000 blood specimens were tested for white diarrhea of poultry.

Rural organization and markets.—This project was continued in cooperation with the Bureau of Markets, United States Department of Agriculture, and had the services of two men. A total of 215 days were spent in the field, and 128 meetings and 527 conferences were held, at which 11,489 people were met and addressed. Twenty associations, incorporated under the Oregon cooperative law, have been established during the year. Over 100 sets of articles of association, constitutions, and organization contracts were prepared and distributed. In changing from the sack system to the bulk handling of grain the work has been of particular service in the organization of cooperative elevator associations and in giving advice as to the best type and size of buildings to erect.

Animal husbandry.—The work of this project was handicapped by the lack of a field specialist. It was carried on by the regular college staff, who spent 60 days in the field and addressed 32 live-stock meetings with 5,161 farmers present. A wool-demonstration car was routed through seven counties in eastern Oregon for two weeks, in cooperation with the Bureau of Animal Industry, United States Department of Agriculture, which fitted up the car. The car made 10 stops in the State. Sheepmen came from 50 to 60 miles to the meetings, and the work of the car was decidedly successful.

Poultry husbandry.—The work of this project was interrupted by the resignation of the extension specialist. One hundred and twenty-three poultry meetings were held during the year, with an attendance of 8,606 persons. Forty-five farmers were visited and given personal assistance. Demonstrations were conducted with 13 flocks, containing 494 breeding hens, which were tested for white diarrhea, and all but 2 flocks were found diseased. The owners have benefited from this work since then by being able to hatch chicks free from disease.

Farm crops.—The extension service included under farm crops the work done in drainage and irrigation, soils, and farm mechanics. In these lines there were 336 days of field work, during which 178 meetings were held, attended by 8,983 people. Drainage and irriga-

tion work was the most important feature of the project. Sixty farm-drainage systems, affecting 5,650 acres were designed or surveyed and 26 district or community drainage systems affecting 419,500 acres were aided. Six irrigation districts, including 68,800 acres, were organized or substantially aided. As a result of one farm demonstration of a tile-drainage system, 5 of 10 neighboring farmers put in tile drains during the year. Demonstrations have also been made with flax, wheat, corn, oats, potatoes, vetch, clover, and barley.

SURVEY.

The formation of community committees for directing the local extension work should greatly strengthen the county organization. Home-demonstration work was successfully organized in three counties. The farm-home study tour is a unique method of extension instruction, valuable in the beginning of home-demonstration work. The assistance given the dairy industry in organizing its marketing facilities has been particularly fortunate. The work of the agent in marketing, in encouraging the marketing of grain in sacks rather than in bulk, has also been of large significance. The increasing number of volunteer leaders of boys' and girls' clubs and the very large percentage of the membership continuing the work from the previous year, indicate that club work is having a healthy growth. The agricultural club for young men over 18 is developing a new field of extension effort, the result of which will be of interest to extension workers generally. The work of the extension division shows steady progress in the integration of its forces and the improvement of its methods—evidence that it is alive to the needs of its constituency.

PENNSYLVANIA.

Division of Agricultural Extension Work, Pennsylvania State College,
State College.

M. S. McDOWELL, *Director*.

Organization and administration.—There were no changes in the general organization from that of the previous year. On account of the war special effort was made to organize farm bureaus and to place agents in unorganized counties. Work has been organized in 27 new counties. With the increasing number of county extension representatives, there has been a larger demand for assistance by specialists. To meet this situation specialists in animal husbandry, agronomy, vegetable gardening, entomology, poultry, and farm management were added to the extension staff.

Publications.—During the year 18 extension circulars, aggregating 289 pages and with a total edition of 862,000 copies, were published. A monthly Extension Bulletin was also sent to a mailing list of 45,000

and formed a medium of news and information concerning the research and extension work of the college. Several posters were also issued for special purposes. A special weekly news service, sent to local papers through the county representatives, who gave the articles a local application, was inaugurated in May.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal.....	\$77, 638. 54
Smith-Lever, State.....	67, 638. 54
United States Department of Agriculture, farmers' co-operative demonstration work.....	10, 479. 00
Bureau of Animal Industry.....	2, 683. 83
Total	158, 439. 91

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, extension schools, fair exhibits and farm organization, dairying, horticulture, animal husbandry, agronomy, poultry, and entomology. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work and dairying.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents, June 30, 1916, 22; June 30, 1917, 45. Work was supervised by the extension director, serving as county-agent leader, with three assistants.

Among the results of the activities during the year were the following: Six thousand two hundred and eleven farmers were induced to select seed corn in the fall for 58,875 acres, and 2,244 farmers tested their seed corn, resulting in 21,038 additional acres being planted with tested seed; 10,501 farmers were persuaded to treat their seed oats for the control of smut on 101,467 acres and 3,585 farmers treated their seed potatoes for the control of potato diseases at suggestion of agents, resulting in 5,587 acres being planted with treated seed. The raising of more legumes was encouraged, both for live-stock feeding and soil improvement, resulting in 484 farmers sowing 1,181 additional acres of alfalfa and 641 farmers sowing 3,093 acres of soy beans. Three hundred and fifty-five farmers followed suggestions of agents in the care of their orchards.

The State took a leading part in live-stock improvement and the county agents devoted considerable time to the elimination of unprofitable cows and the use of more pure-bred stock. They organized or reorganized 30 cow-testing associations and 22 live-stock breeders' associations during 1917. Seventeen thousand one hundred and

twenty-one cows were under test in associations organized by agents, resulting in 1,681 cows being discarded as unprofitable. The work of the cow-testing and breeders' associations, with the assistance of agents, resulted in 249 registered bulls and 688 registered cows being secured and 4,922 farmers adopting balanced rations for their herds. The building of silos was recommended, resulting in 517 new silos being built.

Attention was given to soil improvement and better farm practices. This resulted in 324 farmers adopting crop-rotation systems recommended and 113 drainage systems being planned and put in. At the suggestion of agents, 2,973 farmers used 2,874 tons of chemical fertilizers and 750 of these farmers were given assistance in home mixing their fertilizers. The agents tested soil for acidity on 1,090 farms, 122 local sources of lime were developed, 28 limestone crushers were introduced, and 21,908 tons of lime were used. Ten thousand one hundred and twenty-eight acres of hay land were top-dressed, and 4,338 acres of clover were plowed under for green manuring.

Thirty-two cooperative buying and selling associations and farmers' exchanges were organized with assistance of agents. These did more than \$250,000 worth of business, saving \$31,947 to the farmers.

The agents conducted 2,081 definite demonstrations, involving 31,135 acres of crops and 2,363 live stock. In connection with these demonstrations, 1,113 meetings were held, attended by 75,955 persons. The principal demonstrations during the year were conducted to show the possibility of controlling oats smut and potato diseases.

In addition to the work mentioned above, the agents carried on several definite campaigns to increase crop and live-stock production and to aid in food conservation to meet the war needs, resulting in farmers being assisted in securing seed grain as follows: One thousand one hundred and eighty-five farmers were given assistance in obtaining 3,043 bushels of seed corn for the 1917 crop and in saving 62,510 bushels of seed corn for the 1918 crop; 2,949 farmers were assisted in locating or obtaining 16,799 bushels of seed buckwheat; 6,079 farmers were assisted in securing 43,422 bushels of seed potatoes; and 1,373 farmers secured help in locating seed beans. As a result of definite campaigns for increased crop production, the corn acreage was increased by 24,939 acres, thereby increasing the production 371,349 bushels; the buckwheat crop was increased by 21,766 acres, increasing the production nearly one-third of a million bushels; and 28,585 additional acres of potatoes were planted, thereby increasing the production nearly 1,000,000 bushels, and the wheat acreage was increased by nearly 40,000 acres.

The farm-help problem being a serious one, arrangements were made to assist farmers in securing suitable farm help. Four thousand four hundred and nineteen requests for farm help were received at county agents' offices and 1,966 laborers were supplied. One thou-

sand seven hundred and ninety-seven farmers were assisted in locating 2,424 tons of fertilizers, and 7,511 additional cattle were produced. As a result of an active campaign to encourage sheep raising, a number of carloads of breeding stock were distributed in various farm-bureau counties. Three hundred and ninety farmers were assisted in securing power sprayers, and 22 farm-loan associations were organized with assistance of agents.

In the campaigns for food production and conservation 12,341 persons were assisted in home-garden work, 5,411 farmers received information regarding storing of fruit and vegetables, and 978 canning demonstrations were held for women, aside from club work, resulting in nearly 500,000 additional quarts of fruit and vegetables being canned and 66,060 pounds of fruits and vegetables being dried.

In doing the work the agents visited 15,627 different farmers on their farms, gave information to 31,429 persons at their offices, and took part in 4,360 meetings, attended by 286,160 persons. Two thousand nine hundred and six newspaper articles were written by agents to acquaint farmers with improved farm practices and results of demonstrations, and 65,734 individual letters were sent out, and nearly 500,000 circulars and circular letters were mailed out. Fifty-four agricultural observation parties were conducted to visit demonstrations, attended by 15,707 persons.

A definite program of work was adopted with the approval of the executive committee of each farm bureau, and particular attention was given to see that the work covered the principal problems in the various sections of the county, also that the work was well distributed throughout the year.

Home economics.—The work in home-economics extension was a continuation and enlargement of that carried on during the two previous years, the State staff having been increased by two assistants. To meet the war emergency a systematic campaign in the canning and preservation of fruits was planned. Sixty-six counties were reached during the summer; 913 lectures and demonstrations were given, with an attendance of 29,693.

Boys' and girls' club work.—Two hundred and nineteen club groups were organized, with a total enrollment of 6,645 boys and girls, of which number 5,360 completed all the work. The work was organized as a project of the county farm bureau, and local leaders were secured under much the same plan as for other farm-bureau projects. In Mercer County a young farmers' club furnished the local leaders, while in other counties, where club work has been organized several years, fourth-year club members were used as local leaders.

The value of products and the cost of production in the different projects were not reported. Eighteen corn clubs were organized,

with a total enrollment of 999 members, who completed all work; 14 potato clubs enrolled 313 members, of whom 242 finished the work; 102 home-garden clubs enrolled 3,433 members, of whom 2,800 completed all work; 4 canning clubs enrolled 80 members, all of whom completed the work; 10 poultry clubs enrolled 246 members, of whom 225 completed the work; 9 baby-beef clubs enrolled 68 members, of whom 65 completed all work and reported the feeding of 65 calves; 21 pork clubs enrolled 344 members, of whom 340 completed all work; 2 bread clubs, with 34 members, reported their work completed; 35 stock clubs enrolled 1,025 members, of whom 1,000 completed all work; and 4 dairy-calf clubs enrolled 103 members, of whom 99 completed all work.

Extension schools.—Five extension schools were held, with a total attendance of 4,000, half of whom were women. The program of each school consisted of two sections—one in home economics and the other of those phases of agriculture of particular local interest.

Fair exhibits.—A new fair exhibit was assembled the previous summer and was installed at 13 fairs. It is estimated that 350,000 people saw the exhibit, and the general interest shown in it indicates that it has a real educational value.

Dairying.—Assistance was given creameries in improving the quality and quantity of their output, 195 visits being made to 54 creameries. Plans were drawn for creameries, milk stations, dairy houses, and condenseries. Cooperative creameries were assisted in putting their plants on a profitable basis. Seventy butter demonstrations were held, 186 rations were balanced, and 877 visits made to farms. In cooperation with the Bureau of Animal Industry of the United States Department of Agriculture an assistant supervised the work of 33 cow-testing associations, involving 925 herds of 13,921 cows. Sixteen new cow-testing associations were organized. Assistance was given in the erection of 18 silos, the construction of 9 milk houses and 8 barns, and the remodeling of 47 others. Forty-seven farmers were assisted in keeping herd records. Aid was given in the organization of 3 dairy associations and 2 bull associations of 7 blocks, involving 57 herds of 440 cows.

Horticulture.—The pruning and spraying of orchards, grading and packing of fruit, and fire-blight control were the leading lines of work; 92 demonstrations and lectures were given and 114 meetings attended, through which 5,066 people were reached.

Vegetable gardening.—On account of the food situation and the demand for assistance with home gardens a vegetable specialist was added to the staff early in the spring. His time was spent largely in giving illustrated lectures, giving assistance to gardeners and those

in charge of community gardens, and becoming familiar with the gardening situation in the counties.

Animal husbandry.—This project was started in August, 1916, and the initial work consisted in a general survey of the live-stock problems of the State and the formulation of a plan of work based upon the needs of definitely defined live-stock regions. Steer-feeding demonstrations were held on 17 farms in 3 counties, at which the value of silage and proper housing were emphasized. Thirty-five blue-prints of the open shed for steers were later furnished. Five hog demonstrations were held and 75 blue prints of the self-feeder were sent on request after these meetings. At meetings arranged by the farm bureaus in five counties, the feeding and breeding of horses was discussed. Sheep feeding and management were discussed at meetings in seven counties. Two hundred and forty-five farms were visited. 87 visits were made to county agents, and stock was judged at 9 fairs.

Agronomy.—An extension specialist in agronomy was added to the staff in February, 1917. Owing to the war the work was largely of an emergency nature. Corn variety demonstrations were held in 35 counties and campaigns for oat-smut eradication in 36 counties. Four demonstrations in pasture improvement and eight in top-dressing meadows with nitrate of soda and acid phosphate were held. This demonstration work was given in cooperation with the county agents.

Poultry husbandry.—Poultry extension was started in poultry accounting and the selection and culling of inferior breeding stock. Flock records were secured from 75 farmers in 24 counties as a basis for an estimate of the profit of poultry on Pennsylvania farms. Owing to the lack of records on most farms, a simple poultry account book was compiled, and 60 of these were furnished to farmers willing to keep accounts. Fifteen demonstrations in caponizing were conducted, and 51 demonstrations in the selection of laying stock were held, at which 1,900 hens were individually examined. At one of these demonstrations, a flock of 150 was divided into two equal lots of layers and non-layers. During the next few weeks, the 75 birds classed as nonlayers did not lay an egg, while the 75 classed as layers laid as many as the 150 hens had previously. Eighty-two farms were visited, 32 county agents were assisted, and 2,825 people were addressed at 8 lectures and 66 demonstrations.

Entomology.—An entomologist was added to the extension staff in September. Two demonstrations were conducted in Erie County in the control of the onion maggot by the use of poisoned bait. In this connection two demonstrations were held to show the control of onion smut by the use of formaldehyde at seeding. Meetings were held in four counties in cooperation with the county agents to arrange

for community potato-spraying organizations. Three assistants were placed in the field during the summer to assist with the insect problems of certain localities.

Farm organization.—The county agents in 28 counties assisted 494 farmers in starting simple farm accounts. Farm-analysis records were taken on 167 farms. Three hundred farm records were taken in nine counties on the cost of milk production. During the summer the specialist devoted most of his time to the farm-labor situation. In this work 110,000 labor inquiry sheets were sent to farmers through the county agents.

SURVEY.

Special effort on account of the war resulted in more than doubling the number of county agents and in the rapid organization of farm bureaus. The general adoption of definite programs of work by the farm bureaus will greatly increase their efficiency. The employment of more extension specialists should materially assist the work of the county agents. The demonstration work with live stock and the promotion of the use of lime for correcting soil acidity form notable achievements of the county agents. Home-demonstration work has been carried on by district agents, only two counties having county agents. As this work becomes better organized, the county unit will probably be found to be better adapted for efficient work. The value of local volunteer leadership for boys' and girls' clubs is being appreciated, though the local groups seem often to be rather large. More direct contact between the State club leader and the local clubs through county leaders might stimulate the local groups.

RHODE ISLAND.

Division of Extension Service, Rhode Island State College, Kingston.

A. E. STENE, *Director*.

Organization and administration.—There has been no change in the general organization of the extension work. Very satisfactory cooperative arrangements exist with the State board of agriculture. The director of extension is also State entomologist, and devotes one-third of his time to the latter position.

Publications.—Owing to the limitation of funds the publications of the United States Department of Agriculture are largely used. Only one bulletin was published in an edition of 3,000 copies.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917.

Smith-Lever, Federal-----	\$10, 400. 24
Smith-Lever, State-----	400. 24
United States Department of Agriculture, farmers' co- operative demonstration work-----	4, 000. 03
College-----	627. 57
Total-----	15, 428. 08

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, agronomy, and poultry. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work and boys' and girls' club work.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Counties with agents, June 30, 1916, 4; June 30, 1917, 4. These counties are covered by 2 agents. The work was supervised by the director of agricultural extension, acting as county-agent leader.

Among the outstanding results of the work of the 2 county agents were the following: Thirty-three farmers were assisted in fall selection of seed corn; 44 farmers were given assistance in testing seed corn for germination; and 30 farmers were given assistance in treating their seed potatoes for the control of potato diseases, and 58 additional acres were planted with treated seed; 28 farmers raised 240 acres of soy beans according to recommendations of the agents; and 18 farmers were given assistance in the care and management of their orchards, containing 30,300 trees. Upon the recommendation of the agents, 180 tons of lime were used for the correction of soil acidity, and 200 tons of fertilizer were used by 60 farmers.

Assistance was given in the organization of two farm-loan associations; 505 persons received assistance in home gardening; and 55 farmers received information in regard to storing fruit and vegetables; 366 applications were received at the county agents' offices for farm labor, and 314 laborers were placed.

In doing their work the Rhode Island agents made 1,106 visits to farms, gave information to 2,491 persons at the office, and took part in 265 meetings, attended by 8,966 persons. Farm bureaus are co-operating with each agent.

Home economics.—The special feature of home-economics work was a series of classes, extending over a period of from 6 to 10 weeks, and planned to cover the entire State. One lesson a week was given in each community, the demonstrator returning the following week

to continue her program. In 15 of these classes the enrollment was 3,724. Exhibits, illustrating better living conditions and demonstrations of cooking and of labor-saving appliances, were given at county fairs. To meet the demands of the war emergency, 5 assistants were appointed. These women were given special training at the State agricultural college in canning and in drying before being sent over the State to conduct a campaign for the preservation of surplus fruits and vegetables. As a result of this campaign, tons of fruits and vegetables were saved. Early in the fall the renovation of clothing was added to the conservation program.

Two city home-demonstration agents in Providence worked in co-operation with the Providence County farm bureau and women's organizations. These agents gave demonstrations in war cookery to organized classes. A valuable service rendered in Providence was the furnishing of recipes and the giving of demonstrations that are adapted to each day's food supplies on the local market. This information was printed in the city papers as the home-economics feature of the information service inaugurated in Providence by the Bureau of Markets of the United States Department of Agriculture. Through this cooperative service much perishable food was conserved, as women have been guided to buy intelligently through being informed as to conditions on the market.

Boys' and girls' club work.—The boys' and girls' club work was conducted by a State leader and nine assistant and county club leaders paid cooperatively by the State college of agriculture and the United States Department of Agriculture. The assistant and county leaders are employed from two to five months during the year. Three hundred and one club groups were organized, with a total enrollment of 9,409 club members, 8,325 of whom reported products to the value of \$116,611.21, produced at a total cost of \$50,158.30. Seventy-five per cent of the club groups were organized and did club work during the preceding year. Three hundred canning demonstrations, with a total attendance of 12,000 club members, women and men, 200 field demonstrations, 10 club fairs and festivals, and 10 State, county, and local club exhibits were conducted by club leaders. One conference was held during the year for the training of club leaders. Two thousand club plats were visited by the club leaders, and 10,000 copies of follow-up instructions were distributed by the State college to help the club members in their work. The work of the year involved 10 different club projects.

The following table gives some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	5	195	23 acres.....	1,062 bushels..	\$2,124.00	\$1,083.95
Potato.....	3	18	24 acres.....	456 bushels....	738.72	264.44
Home garden.....	140	4,776	53,120 sq. rods.		34,449.20	13,468.72
Family garden.....	5	1,475	32,000 sq. rods.		46,236.68	19,213.78
Poultry.....	65	313	5,608 fowls.....	1,366 chicks, 11,037 dozen eggs.	6,211.26	2,115.33
Pork and crop.....	1	2	32 pigs.....	6,400 pounds..	1,168.00	582.44
Sheep.....	1	2	17 sheep.....		135.24	30.00
Canning.....	51	1,067		84,245 quarts..	24,099.01	12,782.67
Bread.....	3	6		731 loaves and meals.	109.95	28.93
Garment making.....	27	471		2,050 articles...	1,339.15	588.04
Total.....	301	8,325			116,611.21	50,158.30

Total club enrollment, 9,409.

Agronomy.—Sixteen potato demonstrations to show the relative value of home-grown and Maine seed were held, the northern seed showing an increased yield of from 18 to 60 bushels per acre. Four alfalfa demonstrations were started. The growing of winter vetch was encouraged. Two hundred and sixty-nine tests for soil acidity were made upon request. One hundred and twenty-five bushels of soy-bean seed were distributed.

Poultry husbandry.—The home-reading course was supervised; 21 lectures were delivered; 11 judging demonstrations were given; 41 poultry yards were visited and advice given; and 4 flocks were tested for white diarrhea. Considerable assistance was given to the organization of boys' and girls' poultry clubs. In October, 1917, the specialist was transferred to give his entire time to this work, in cooperation with the Bureau of Animal Industry, United States Department of Agriculture.

SURVEY.

County-agent work is becoming more firmly established and is supported by farm bureaus. No very radical change in the program of work was made to meet war conditions. The home-economics courses, in which weekly classes were held in every community, were the means of taking the war message of food conservation to nearly all the rural women of the State. Boys' and girls' club work was efficiently organized, as shown by the large percentage of membership reenrolled and the high proportion completing the year's work.

SOUTH DAKOTA.

Division of Extension, South Dakota College of Agriculture and Mechanic Arts, Brookings.

G. W. RANDLETT, *Director*.

Organization and administration.—There was no change in the general plan of extension work from that of the previous year. A new State leader for county-agent work was appointed in January. Farmers' institutes were discontinued by an act of the legislature. The extension service cooperated with the live-stock sanitary board in the prevention of animal diseases, and a better understanding and closer cooperation was secured with certain of the more influential farmers' organizations.

Publications.—A farm-record book for use in farm-management demonstrations and two extension circulars were published during the year.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal.....	\$21,305.96
Smith-Lever, State	11,305.96
United States Department of Agriculture, farmers' co-operative demonstration work.....	7,800.00
Bureau of Biological Survey.....	200.00
Bureau of Animal Industry.....	1,350.00
State appropriations.....	16,632.63
County.....	16,562.49
Total.....	75,157.64

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, extension schools, farm-management demonstrations, horticulture, animal-disease control, agricultural engineering, live-stock improvement, dairying, field crops, and grasshopper control. Funds from the United States Department of Agriculture were used in support of the following projects: Boys' and girls' club work, farm-management demonstrations, extension schools, grasshopper control, and creamery extension work.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents, June 30, 1916, 11; June 30, 1917, 13. Work was supervised by the director of agricultural extension serving as county-agent leader.

Among the outstanding results of the work were the following: Four hundred and seventy-three farmers were assisted in selecting seed corn in the fall for 17,170 acres, and 413 farmers tested their seed corn for germination, resulting in 18,630 additional acres of corn being planted with tested seed at the suggestion of agents. The raising of more legumes was encouraged, 483 farmers sowing 4,877 acres of alfalfa and 100 farmers sowing 1,298 acres of sweet clover. Three live-stock breeders' associations were organized; 194 registered bulls, 146 registered cows, and 307 registered boars were secured by farmers at suggestion of agents; and 278 registered sires were transferred to other farms. The agents brought about the vaccination of 31,265 animals for blackleg and nearly 9,000 hogs for cholera; and 18,931 head of cattle were treated for anthrax by the agents or at their suggestion. Seven hundred and forty farmers were induced to keep farm accounts, and 313 farmers modified their management as a result of farm-analysis records taken. Cooperative buying and selling associations organized with the assistance of the agents did more than \$250,000 worth of business. The South Dakota agents conducted 1,443 demonstrations involving 3,616 acres of crops and 17,684 live stock.

In addition to the above work, the agents took a leading part in the direction of the work of the county councils of defense and carried on definite campaigns to increase crop and live-stock production to meet the war needs. The following quantities of seed were secured for farmers: Wheat, 11,795 bushels; oats, 5,538 bushels; corn, 2,795 bushels; barley, 5,420 bushels; and seed potatoes, 11,955 bushels. As a result of these campaigns for increased crop production 6,340 additional acres of wheat were sown; 9,640 additional acres of corn, thereby increasing the production of corn 222,200 bushels; and 2,465 additional acres of oats, increasing the production more than 100,000 bushels. Fourteen thousand two hundred and ten additional sheep were placed on farms and there was an increased production of 5,010 cattle and 4,360 hogs in the counties with agents.

Assistance was given in the organization of six farm-loan associations. Seven hundred and seventy-two persons were assisted in home-garden work, and 695 farmers received information regarding storing of fruit and vegetables. One hundred and sixty-three canning demonstrations were held for women, resulting in 20,710 additional quarts of fruit and vegetables being canned. Through the offices of the county agents 2,567 farm laborers were placed.

The South Dakota agents made 5,889 visits to farms, gave information to 10,659 callers at their offices, and took part in 928 meetings attended by 51,552 persons.

Home economics.—Home-economics extension was conducted through short courses, single demonstrations, and exhibits at fairs.

The short courses were four days in length. Two hundred and seven meetings were held, with an attendance of 12,295. Special attention was given to rural-school luncheons, canning of meats, fruits and vegetables, and household equipment. After the emergency funds were available two district home-demonstration agents were appointed.

Boys' and girls' club work.—The work was conducted by a State club leader and an assistant leader, who were assisted by 29 volunteer county leaders. One hundred and sixty-three club groups were organized during the year, with a total enrollment of 4,730 boys and girls. Sixty per cent of the club groups had been engaged in club work in the preceding year, while 20 per cent of the total enrollment had done club work in 1916. The groups reported products to the value of \$51,018.90, produced at a total cost of \$15,514.36. The club leaders conducted 119 canning demonstrations, with a total attendance of 7,155, and held 20 field demonstrations, 10 club fairs and festivals, 4 leaders' training conferences, and 25 local county and State club exhibits.

As a special war-emergency achievement the boys' and girls' clubs did an important piece of work through the home-canning clubs and the mother-daughter clubs. Besides canning a total of 31,486 jars of fruit, vegetables, meats, and soups for use in their own homes, the boys and girls, through their club organizations, canned a large amount of fruit and vegetables for their several communities.

The following table gives some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	32	422	422 acres.....	11,816 bushels.	\$11,530.40	\$3,781.12
Potato.....	28	273	32 acres.....	5,120 bushels..	6,475.00	1,098.96
Home garden.....	12	536	6,432 sq. rods.....	.....	4,288.00	1,168.48
Poultry.....	18	392	3,528 fowls.....	3,136 chicks....	3,029.50	1,003.52
Baby beef.....	1	11	16 animals.....	4,400 pounds....	528.00	352.00
Pork and crop.....	12	216	216 pigs.....	24,300 pounds..	3,888.00	1,701.00
Canning.....	23	383	.....	31,486 quarts..	18,500.00	4,994.28
Bread.....	18	300	.....	4,800 loaves....	480.00	192.00
Garment.....	19	360	.....	1,600 garments	2,300.00	1,223.00
Total.....	163	2,893	.....	.....	51,018.90	15,514.36

Total club enrollment, 4,730.

Farm-management demonstrations.—Special effort was made in teaching farmers how to study their farming as a business. Work was conducted in six new counties during the year, making a total of 13. Eight hundred and thirty-eight farmers began studying their

business through simple farm accounts. Much attention was given to teaching farmers the principal items which enter in the cost of producing farm products. The economic idea which this work involves was taken up by other agricultural teachers who cooperated in the work. Farm-analysis records were taken on 83 farms. These and 122 records taken the previous year were summarized, returned, and personally discussed with the farmers. As a result of the farm-management demonstration work 313 farmers modified the management of their business in order to increase the effectiveness of their work.

Horticulture.—In fruit growing there were a few pruning, grafting, and spraying demonstrations, and 10 orchards were used for cultivating and mulching demonstrations. The planting of gooseberries, strawberries, and crab apples was stressed. Lists of desirable varieties of fruits for different parts of the State were sent out. In the windbreak work there were 72 demonstration plantings, and about 300 farmers either planted new windbreaks or added to those already planted. The gardening work covered vegetable varieties, cultural methods, vegetable storage, and storage cellars. The potato-improvement work is giving good results in seed selection, seed growing, and increased fields. In the landscape work about 150 planting plans were furnished for home improvement, and 300 people followed directions for tree planting around their homes. In connection with schoolyard improvement the pupils of 180 schools followed plans in setting out 72,000 plants.

Animal-disease control.—This project was started at the beginning of the year with a veterinarian in charge. The work was closely coordinated with that of the State live-stock sanitary board, but was of a purely educational nature; 96 days were spent in the field in work with the county agents in 11 counties; 151 farms were visited and 36 meetings were held with a total attendance of 1,963. Half of the farm visits were occasioned by hog cholera, anthrax, and necrobacillosis. During three winter months, 38 farmers' short courses were addressed with an attendance of 3,163. Twenty-three animal-disease schools were held in four counties, largely for instruction in hog-cholera control. The first week in June was designated as black-leg vaccination week, and was given wide publicity and organized by the county agents. About 25,000 doses of vaccine were sent out, and it was estimated that 50,000 cattle were vaccinated during the week.

Agricultural engineering.—Thirty-one demonstrations were started during the year, at which 13 field meetings were held; 44 farms were visited relative to farm buildings. Sets of plans for barns, houses, and septic tanks were furnished each county agent. Several demonstrations of concrete construction were given. One hundred and twelve days were spent in instruction at extension schools.

Dairying.—General assistance was given the creameries of the State and special help was given four cooperative creameries in the improvement of their butter and in increasing the efficiency of their plants. This work is in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture.

Live-stock improvement.—Live-stock instruction was given at extension schools for 92 days in 32 places, with an attendance of 12,336. The improvement of live stock was presented to 2,500 people through judging demonstrations at 7 county fairs, colt shows, 2 "better stallion days," and 2 "boys' camp schools."

SURVEY.

The appointment of a State leader and assistant State leaders made possible much better supervision of county-agent work. Besides carrying on an increased amount of demonstration work, the county agents took a leading part in the campaigns for greater food production under the county councils of defense. Extension work in home economics was largely conducted through meetings and schools, home-demonstration work not having been inaugurated. Membership in boys' and girls' clubs nearly doubled, while the value of their products increased nearly fourfold. Blackleg-vaccination week was a successful undertaking of the county agents working under the direction of the veterinarian, and is a good example of the advantage of a short seasonal campaign for certain types of extension work.

UTAH.

Division of Agricultural Extension, Agricultural College of Utah, Logan.

E. G. PETERSON, *Director* (resigned September, 1916).

JOHN T. CAINE, III, *Director* (appointed September, 1916).

Organization and administration.—The general plan of extension work was not changed from that of the previous year. In September the extension director was elected president of the agricultural college and the former assistant director was appointed to his place. The State county-agent leader was made assistant director and is in general charge of the field work of the specialists as well as of the county agents so that through him all field work is coordinated. The members of the extension staff are given official standing and title in the faculty of the college, although the division of extension is coordinate with the college and experiment station. There is perfect understanding between the three branches of the institution, which has been of great benefit to the extension work. Cordial agreements or understandings exist with all the State offices that deal with

agricultural work, and with the State council of defense, and the food production and conservation committee.

Publications.—Thirty leaflets and circulars, 4 posters and 1 report were published, with an aggregate of 65 pages, and a total edition of 70,000 copies.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$14, 467. 35
Smith-Lever, State	4, 467. 35
United States Department of Agriculture, farmers' cooperative demonstration work.....	10, 617. 37
Bureau of Biological Survey.....	1, 200. 00
Bureau of Animal Industry.....	1, 525. 00
State appropriations.....	21, 777. 91
County.....	8, 790. 00
Other sources within the State.....	1, 011. 42
Total	63, 856. 40

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, farm-management demonstrations, dairying, dry-farming demonstrations, and specialists in irrigation, and veterinary science. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, home economics, boys' and girls' club work, farm-management demonstrations, dairying, and control of mammal pests.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties covered by agents June 30, 1916, 8; June 30, 1917, 15. Work was supervised by the county-agent leader and one assistant.

Among the results of the work were the following: Three thousand two hundred and forty-eight farmers followed suggestions of agents in treating seed oats for smut, resulting in 17,665 additional acres of oats being sown with treated seed; and 3,869 farmers treated their seed potatoes for the control of potato diseases, resulting in 6,281 additional acres of potatoes being produced from treated seed. Considerable time was devoted to encouraging live-stock improvement, resulting in the organization of two live-stock breeders' associations and two cow-testing associations. Largely through these associations, 466 cows were under test, 33 being found unprofitable, and 190 registered bulls and 105 registered cows were secured. Farmers or

veterinarians vaccinated 1,551 hogs at the suggestion of agents, and farmers were influenced to treat 6,639 animals for the control of blackleg. One hundred and fifty-nine farm-analysis records were taken by the agents, and 373 farmers were induced to keep farm accounts. The English sparrow is an important crop pest in the State, and systematic campaigns were conducted in two counties for their control, resulting in 123,500 dead sparrows being actually counted by the cooperating farmers conducting demonstrations, while thousands of others were undoubtedly killed. The Utah agents arranged for and supervised 792 demonstrations, involving 9,285 acres of crops and 3,287 head of live stock.

The county agents used a well-developed "follow-up" system, by means of cards showing the nature of demonstrations conducted, condition of demonstrations at time of each visit, recommendations made, and, finally, the results accomplished. The follow-up cards were classified in the agents' offices by counties and districts, and when visits were made to any particular district the agents took the cards containing the records of demonstrations in that district with them. In this way a close check was kept on the work of each co-operator and demonstrator, and the results obtained were therefore much more reliable and accurate than they would be without using this plan.

In addition to the above work the agents conducted definite campaigns to encourage an increased production of crops and live stock to meet war needs. In some counties every farmer was visited personally by farm-bureau committees and urged to do his best. These campaigns resulted in the following amounts of seed being secured for farmers: Wheat, 3,262 bushels; oats, 4,796 bushels; potatoes, 8,407 bushels. These campaigns resulted in 6,718 additional acres of wheat being sown, 1,961 additional acres of oats, 6,666 additional acres of corn, and 2,500 additional acres of sugar beets being raised.

Increased live-stock production was stimulated, resulting in 2,330 additional cattle, 1,656 additional hogs, and 9,370 additional sheep being raised. Thirty-two farm-loan associations were organized with assistance of the agents, and 314 farmers were given assistance in securing farm credit. One thousand two hundred and ninety-four persons were assisted in home gardening, and 44 canning demonstrations were held for women, aside from club work, resulting in 88,125 additional quarts of fruit and vegetables being canned. One hundred and eighteen thousand pounds of fruits and vegetables were dried as a result of a campaign to encourage drying as a means of conserving food.

In doing the work the agents made 9,530 visits to farms, gave information to 5,417 persons coming to their offices, and took part in

1,003 meetings attended by 48,922 persons. At the beginning of 1917 six counties had well-developed farm bureaus, with a total membership of 2,065. On December 1 there were 11 farm bureaus, with 6,426 paid-up members. Most of the farm bureaus publish a small monthly news sheet dealing with local agricultural topics of interest to farmers, making announcements of bureau policies and meetings, and containing a free exchange list, where members may offer live stock, seed, etc., for sale or exchange.

Home economics.—One leader and two assistants comprised the home-economics extension staff until the war emergency made a larger force imperative. These three women carried on a varied program of work through the Women's Relief Society, a church organization of the State, and through groups of women which they had been instrumental in organizing. Sixty home-economics clubs, with a membership of 3,000, located in all sections of the State, met regularly throughout the year to study various phases of home making. During the first part of the year 481 homes were visited and 52 demonstrations on the canning of meats, fruits, and vegetables were given. There was a marked increase in the number of isolated country homes reached. When war was declared nine women were appointed in districts to assist women in their war activities. The program was a vigorous campaign to save surplus foodstuffs, particularly fruits, meats, and vegetables, by community canning and drying. Short courses were held in 61 towns, with an attendance of 4,287. A clothing survey was made, and followed by a campaign for renovating clothing. One outstanding result of this was that many families throughout the State were not only better clothed than formerly, but at much less expense, and there was a marked decrease in the purchase of woolen garments and fabrics. The increased use and canning of home-produced meats, such as rabbits and poultry, and of fish taken from local streams and lakes, was made a feature of the food-conservation program. The keeping of household accounts was included in the conservation project. Women who have used the household-account forms for six months reported a saving of 7 per cent to 10 per cent in grocery bills. Along with the food-conservation program, the home-demonstration agents demonstrated the importance of conserving time, labor, and health by improving the working equipment of the farm home, by giving more attention to home sanitation, and by better cooking.

Urban home-demonstration work was started by appointing an agent for Salt Lake City, where war-cookery demonstrations were given in methods of food conservation and eliminating food wastes in the home. Several enterprises affecting the food supply for the city were initiated, including the placing of fish from Utah Lake on

the city markets at a minimum price, and the establishment of skim-milk and cottage-cheese centers for direct marketing for these dairy products with a view to increasing milk consumption in Salt Lake City.

Boys' and girls' club work.—One thousand three hundred and sixty-seven club groups were organized during the year, with a total enrollment of 36,718 club members, 33,509 of which reported products to the value of \$949,581.70, produced at a total cost of \$355,490.15. During the year the club leaders conducted 65 canning demonstrations, with a total attendance of 3,970 club members, women and men; 56 field demonstrations, 52 club fairs and festivals, and 52 local, county, district, and State club exhibits. Four hundred and ninety-eight club plats were visited by the club leaders during the season, and the club members were assisted in their work by 14,000 copies of follow-up literature, sent to them by the State office. Thirty per cent of the club groups organized had done club work in the preceding year.

The rapid progress made in the junior extension work was largely due to the cooperation of the district boards of education and district school superintendents. Through them the teachers of agriculture and home economics have been employed for 12 months in the year and allowed to act as club leaders for their school districts. There were nine regularly appointed district leaders, and the Federal emergency food bill made possible the employment of 31 additional emergency club leaders and an additional State leader.

The first club-leaders' convention was held in Provo with an attendance of 34 leaders and 5 district school superintendents. The first State fair school was held at the State fair at Salt Lake City, with 54 boys and 31 girls housed in tents.

Through the boys' and girls' club groups working under the war-emergency program, special results were obtained in food production and food conservation, and in home-garden and home-canning work. In the home-garden work 5,260 acres of fresh vegetables were produced at a total net profit of \$219,868. In the home canning there were put up for home use, in glass or tin, 32,600 quarts of fruit, 19,683 quarts of vegetables, and 1,475 quarts of meats and soups, and for sale 2,622 quarts of fruit. In the pork-production project 181 club groups were organized, with a total enrollment of 3,260 members, of which 3,224 completed the work. These boys and girls managed during the year 5,120 animals, which produced 1,024,000 pounds at a total value of \$137,000.

The following table shows some of the more important results regarding the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	18	792	505 acres.....	31,562.5 bushels.	\$25,250.00	\$14,897.50
Potato.....	26	2,420	1,320 acres.....	153,912 bushels	93,067 20	42,372.00
Home garden.....	321	5,670	841,600 square rods.	.....	315,600.00	95,732.00
Sugar beet.....	145	4,916	2,624 acres.....	28,864 tons.....	202,048.00	70,848.00
Mangels.....	60	980	.....	19,600 tons.....	78,400.00	24,200.00
Poultry.....	34	786	.....	50,820 chicks.....	15,246.00	6,776.00
Pork and crop.....	181	3,224	5,120 pigs.....	1,024,000 pounds.	137,000.00	51,920.00
Dairy calf.....	4	67	67 calves.....	8,040 pounds..	5,210.60	4,168.50
Home canning.....	280	5,460	.....	56,420 quarts..	22,568.00	12,412.40
Bread.....	112	2,108	.....	196,960 loaves.	9,848.00	5,908.80
Garment.....	145	6,103	.....	54,945 garment	40,704.00	23,760.00
Cooking.....	38	845	.....	48,965 dishes.....	2,889.90	1,444.95
Handicraft.....	3	136	.....	560 pieces.....	1,750.00	1,050.00
Total.....	1,367	33,509	.....	.....	949,581.70	355,490.15

Total club enrollment, 36,718.

Farm-management demonstrations.—The work was extended to four new counties, making a total of 12 counties in which farm-management demonstrations were conducted. The county agents and the farm-management demonstrators assisted 679 farmers in studying their business through simple farm accounts. Farm-analysis records were taken on 314 farms. These and 37 records taken the previous year were summarized, returned, and personally discussed with the farmers. As a result of farm-management demonstration work, 506 farmers modified their business in order to increase their labor incomes.

Dairying.—One-third of the time of a specialist was spent in assisting the county agents. Sixteen farmers were assisted in the erection of silos. As a result of the silo demonstrations, while the first concrete silo in the State was built in 1913, there are now about 450. One cow-testing association of 43 members with 530 cows was reorganized. The specialist addressed 126 meetings, with an attendance of 9,090, and 127 farms were visited. This work is in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture.

Dry-farming demonstrations.—The chief work of the dry-farming specialist consisted in aiding new farmers by correspondence and personal visits; 71 meetings were addressed with an attendance of 6,552; 222 farm visits were made to individual farms, and 45 visits to cooperators' farms.

Specialists.—The work of the specialist in irrigation and drainage filled an important place in the plans for increasing the productive acreage of the State, and the work showed progress. Direct aid to farmers by personal visits and through meetings and demonstrations was given concerning the duty and use of water on the farm, underground water development and its use in irrigation, revision of irrigation systems for increased efficiency, and the drainage of irrigated lands. The specialist was employed cooperatively with the Office of Public Roads and Rural Engineering, United States Department of Agriculture. During the year the veterinarian did valuable work in the control of several outbreaks of hog cholera and of other diseases, and in giving instruction at institutes and extension schools.

OTHER EXTENSION WORK.

Marketing.—A cooperative arrangement was made in May with the Bureau of Markets, United States Department of Agriculture, for a field agent to do extension work in marketing. The market agent had immediate supervision of the fruit-drying campaign carried on by the extension division. Valuable assistance was given the beekeepers with methods of marketing honey. The most important work was in assisting the economic marketing of the tree fruit crop. Other matters which have received attention are: Developing a market for Utah beans; preventing waste in the marketing of potatoes; taking a survey of storage facilities of Utah farms; securing aid through the State council of defense for the timely movement of Utah crops; working out a freight-rate schedule for wheat to the basic wheat centers; and promoting an apple week in Salt Lake City.

Correspondence courses.—The correspondence courses were given the year previous; 80 courses were offered to students, including 45 reading courses in agriculture and 12 courses in home economics; 613 students were enrolled, and 11 extension study classes were organized in near-by cities.

Extension schools and farmers' institutes.—Fifteen extension schools were held during the year, with 468 sessions and a total attendance of 58,283, or an average of 124 per session. Farmers' institutes were held at 82 towns in 29 counties; total attendance was 13,092 at 192 sessions. During the year production was increased in nearly every county, and much of the credit for this was due to institute workers.

SURVEY.

The number of county agents doubled and the farm-bureau membership more than trebled. The effective follow-up methods used by the county agents insure tangible results and the elimination of unprofitable projects. The home-demonstration work was pushed

vigorously after the declaration of war by district agents, with fine cooperation from the women's organizations of the State. The achievement of the boys' and girls' clubs in showing a net profit over all cost of production and supervision of over \$500,000 and the almost complete reporting of the large membership enrolled give Utah a premier position in club work. The new work of the specialist in marketing was of peculiar value under war conditions. Extension work in Utah is well organized, has the support of the people, and is meeting its war duties efficiently.

VERMONT.

Agricultural Extension Service, College of Agriculture, University of Vermont, Burlington.

THOMAS BRADLEE, *Director*.

Organization and administration.—The general plan of organization of the extension service and its relationships to other divisions of the institution and other State offices were not changed materially during the year. The State law covering the organization of farm bureaus was amended to require the cooperation of any town in financial support of the work, providing the bureau is organized with at least 200 members. The State commissioner of agriculture continued to cooperate in certain projects of dairy and marketing extension.

Publications.—One circular and one bulletin were published in a total edition of 35,000 copies. In addition, a series of 51 leaflets of the Production and Conservation Series were duplicated and issued in cooperation with the State public-safety committee.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$14, 168. 57
Smith-Lever, State	4, 168. 57
United States Department of Agriculture, farmers' cooperative demonstration work.....	12, 467. 56
Bureau of Animal Industry.....	3, 013. 74
State appropriations.....	4, 266. 11
Total	38, 084. 55

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, farm-management demonstrations, extension schools, fair exhibits, and farm boys' camps. Funds from the United States Department of Agriculture were used in support of the following

projects: County-agent work, boys' and girls' clubs, farm-management demonstrations, and dairy extension.

* A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents, June 30, 1916, 11; June 30, 1917, 11. Work was supervised by the extension director acting as county-agent leader.

The following were some of the results of the work during the year: One thousand one hundred and forty-eight farmers treated their seed oats for smut and 10,624 additional acres of oats were sown with treated seed; 229 farmers treated their seed potatoes for the control of potato diseases and 370 acres were sown with treated seed at the suggestion of agents. The raising of more legumes for feeding and soil improvement was encouraged, resulting in 326 farmers sowing 789 acres of alfalfa, and 1,396 farmers raising 9,169 acres of soy beans. Live-stock improvement received considerable attention, resulting in two live-stock breeders' associations and five cow-testing associations being organized. Twelve thousand three hundred and seventy-five cows were brought under test and 265 farmers adopted balanced rations for their herds. Eleven hundred and ninety-four farmers home mixed 1,367 tons of chemical fertilizers, and 1,315 tons of lime were used. The agents induced 372 farmers to keep farm accounts. With the assistance of the agents cooperative buying and selling associations did more than \$100,000 worth of business. The agents conducted 582 demonstrations, involving 1,633 acres of crops and 96 live stock.

The agents also took an active part in campaigns to increase crop and live-stock production to meet war needs. Through these campaigns 885 additional acres of wheat were sown, thereby increasing the production 16,938 bushels; 2,950 additional acres of corn were planted, increasing the production 30,050 bushels; and 1,526 additional acres of beans were raised, increasing the production 24,790 bushels. One hundred and eighty-seven farmers were assisted in securing 2,455 bushels of seed potatoes, and 3,094 additional acres of potatoes were raised, thereby increasing the production 225,040 bushels. One thousand additional cattle and 800 additional hogs were produced. One hundred and sixteen farmers were assisted in securing the loan of power sprayers. Assistance was given in organizing six farm-loan associations to provide farm credit for farmers.

In doing their work the agents made 8,350 visits to farmers, gave information to 6,408 persons at their offices, and took part in 857

meetings, attended by 43,268 persons. Every county in the State having a county agent had a well-organized farm bureau, the farm-bureau membership in the State being practically 4,000. The farm-bureau associations in the State were greatly strengthened during the year, mainly through developing the executive and community committees to assume active responsibility for planning and promoting the various projects.

Home economics.—Extension schools, canning demonstrations, judging home products at fairs, and study-club organization were the lines of work developed. Preceding the emergency work the State staff consisted of one full-time worker and one assistant on half time. Twelve extension schools were held, with an attendance of 946 women. Thirteen towns were revisited for single demonstrations, and 10 of the 12 extension schools were held in towns where single demonstrations had been given. Following the close of these schools a systematic series of lectures were given to 40 rural women's clubs. The various phases of food conservation and clothing were discussed. Single demonstrations helped to bring to the women a realization of the practical nature of the work. Eighty-seven demonstrations, 39 of which were canning demonstrations, were given, reaching 4,604 women. With the help of the home-economics department a State-wide demonstration campaign for food conservation was conducted. At the request of the Food Administration four summer schools of four days each were held at different educational institutions in the State. Two permanent home-demonstration agents have been placed in Orange and Addison Counties.

Boys' and girls' club work.—The boys' and girls' club work was conducted by a State club leader and an assistant club leader, employed permanently, and an assistant club leader appointed on part time, paid cooperatively by the State college and the Department of Agriculture. These club leaders were assisted in the work by 129 unpaid volunteer leaders of the club groups in their respective communities. Two hundred and eighty-nine club groups were organized with a total enrollment of 4,851 members who reported products valued at \$12,378.15, produced at a total cost of \$6,716.97; 25 per cent of the membership did club work in the preceding year. During the year the club leaders held 46 canning demonstrations, with a total attendance of 2,235 club members, women and men; 32 field demonstrations, 5 club fairs and festivals, and 2 leaders' training conferences were also conducted. Eleven club plats were visited and a total of 89,520 copies of club literature was furnished by the State in helping the club members with their work.

The following table gives some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	12	44	13.3 acres.....	273 bushels....	\$326.42	\$250.12
Potato.....	38	175	22.6 acres.....	3,839 bushels..	4,870.20	1,875.87
Home garden.....	90	480	335.7 square rods.	.....	647.71	281.75
Poultry.....	17	88	558 fowls.....	273 chicks, 722 dozen eggs.	2,430.61	1,914.84
Calf.....	8	53	7 calves.....	.....	65.00	27.75
Pork and crop.....	42	192	126 animals....	18,233.5 pounds.	2,538.35	1,852.57
Lamb.....	1	12	11 lambs.....	.....	65.50	18.65
Home canning.....	30	242	.....	1,560 quarts, 30 jars jelly	329.65	139.94
Bread.....	10	86	.....	559 loaves.....	67.08	5.44
Garment.....	31	135	.....	279 garments..	127.25	64.63
Maple sugar.....	3	34	.....	7,525 pounds..	810.38	260.41
Handicraft.....	7	37	.....	5 pieces.....	100.00	25.00
Total.....	289	1,578	.....	.....	12,378.15	6,716.97

Total club enrollment, 4,851.

Farm-management demonstrations.—The farm-management demonstrators cooperated with the other New England demonstrators in determining whether the farmers were justified in demanding an increased price for milk. Work was conducted in 2 new counties, making a total of 9 counties. Through the county agents and farm-management demonstrators, 372 farmers began studying their business by starting simple farm accounts. Farm-analysis records were taken on 230 farms. These and 67 records taken the preceding year were summarized, returned, and personally discussed with the farmers. As a result of farm-management demonstration work, 105 farmers modified the management of their business in order to increase their labor incomes.

Extension schools.—Twenty-one extension schools were held during the winter, attended by 1,156 persons, or an average of 55 to each school. These schools were conducted on the same general plan as last year.

Fair exhibits.—Exhibits were placed at the State fair, 12 county fairs, and some local fairs. Each exhibit was accompanied by from 1 to 3 extension workers.

SURVEY.

County-agent work is on a firm basis supported by farm bureaus in every county, which have increased their usefulness by the or-

ganization of community committees. Financial support has been strengthened by State legislation requiring appropriations for farm-bureau work by the towns. Extension work in dairying through cow-testing associations and breeders' associations continues to be one of the most important projects. Home-economics projects are assuming larger importance as a result of war campaigns for food preservation and conservation. Boys' and girls' club work made a gratifying growth in membership and even larger increase in profits from the enterprises conducted, probably due to a considerable increase of volunteer leadership of local clubs. Some lines of extension work are still in charge of the commissioner of agriculture, though in close cooperation with the extension staff.

WASHINGTON.

Division of Extension, State College of Washington, Pullman.

W. S. THORNER, *Director*.

Organization and administration.—The extension service was organized upon the plan of a director of extension and four large divisions—county agents, boys' and girls' club work, home-demonstration agents, and farm-management demonstrations—each division being in charge of a State leader or demonstrator. Cordial relations continued with the various departments of the State college and the State experiment station, the State department of agriculture, the State department of education, and the various farm organizations and railroads in the State. The county-agent leader assisted the State department of agriculture in organizing the State and county councils of defense. The department of veterinary science of the State department of agriculture during the year rendered material assistance to the county agents in testing for tuberculosis of dairy cows and other contagious diseases. Through the cooperation of the railroads it was possible for 4,455 people to visit the sheep and wool demonstration car of the United States Department of Agriculture, and for 9,959 people to visit the kitchen, garden, poultry, and home-economics demonstration car of the extension service. Through the cooperation of the State department of education the boys' and girls' club work was greatly extended during the year, and it was possible to send practical information into thousands of homes which otherwise would not have been reached.

Publications.—During the year 8 extension bulletins, with a total of 120 pages and 62,000 copies, were printed. Ninety thousand copies of 15 home-economics extension circulars, 160,000 copies of 16 garden circulars, and 34 poultry extension circulars were mimeographed.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal-----	\$21,957.84
Smith-Lever, State-----	11,957.84
United States Department of Agriculture, farmers' cooperative demonstration work-----	11,890.42
Bureau of Biological Survey-----	200.00
Bureau of Animal Industry-----	2,033.92
College-----	1,282.46
State appropriations-----	6,920.83
County-----	36,266.70
Other sources within the State-----	16,790.00
Total-----	109,300.01

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, farm-management demonstrations, dairying, poultry husbandry, and soils and crops. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, boys' and girls' club work, farm-management demonstrations, dairying, and control of mammal pests.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Number of counties with agents, June 30, 1916, 13; June 30, 1917, 22. The work was supervised by the county-agent leader.

Among the results of the work were the following: Three hundred and forty-six farmers selected seed corn in the fall as suggested, resulting in 1,770 additional acres being planted with fall-selected seed; 374 farmers treated their seed potatoes for the control of potato diseases on 2,342 acres as recommended, and 104 farmers sowed 1,051 acres of alfalfa. Live-stock improvement was encouraged and 12 cow-testing associations and 7 live-stock breeders' associations were organized. Nine thousand one hundred and four cows were under test through associations, resulting in 512 being eliminated as unprofitable. Ninety-six registered bulls, and 74 registered cows were secured, and 158 farmers adopted balanced rations for their herds as recommended. In order to assist in the control of live-stock diseases the agents encouraged many farmers to have their herds tested for tuberculosis, resulting in 13,087 cows being tested. Four thousand six hundred and ninety-five animals were treated for blackleg. One hundred and seventy-three silos were built and 871 crop rotations were adopted as planned. The agents tested soil for acidity on

304 farms, resulting in 701 additional tons of lime being used. One thousand and seventy-four acres of clover were plowed under for green manuring. Five hundred and twenty farmers were induced to keep farm accounts. The cooperative buying and selling associations which the agents helped to organize did more than one-third of a million dollars worth of business, saving \$38,660 to the farmers. The Washington agents conducted 2,127 demonstrations, involving 28,250 acres of crops and 6,993 live stock. The principal kinds of demonstration work conducted were orchard management, seed-corn selection, and insect-pest and plant-disease control.

In addition to the above work the agents did considerable work to stimulate increased crop and live-stock production to meet the war needs, resulting in 2,514 bushels of seed wheat and 2,573 bushels of seed potatoes being secured or located for farmers. The wheat acreage of the State was increased by nearly 50,000 acres, increasing the production by nearly 500,000 bushels. The sugar-beet acreage was increased by 6,400 acres, increasing the production nearly 100,000 tons, and 10,277 additional acres of potatoes were planted increasing the production more than 2,000,000 bushels. Due to the efforts of the agents, 7,321 additional sheep were raised. Fifty-three farm-loan associations were organized with assistance of agents. Four hundred and seventeen canning demonstrations were arranged for women, aside from club work, resulting in 276,770 additional quarts of fruit and vegetables being canned. Thirty-two thousand one hundred and fifty-three persons were assisted in home gardening.

In doing the work the agents made 6,663 visits to farms, gave information to 9,220 callers at their offices, and took part in 1,597 meetings attended by 63,539 persons.

Home economics.—The home-economics extension work with farm women has been conducted by the State leader and one assistant through demonstrations, farmers' institutes, home visits, and personal conferences. Special emphasis has been placed on the balanced meal, best use of waste and by-products, remodeling of clothing and hats, and laundering and cleaning of textiles. Over 4,000 homes have adopted some part of the instruction offered. Four hundred and thirty-three meetings were held with an attendance of 21,217 women. A special campaign was conducted in April by means of a demonstration car; 22 stops were made and demonstrations were given with an attendance of 9,958. To meet the emergency situation, home-demonstration agents have been placed in seven districts. As the work develops and county support is secured, the agents will be placed in counties as a permanent part of the farm-bureau organization.

Boys' and girls' club work.—Nine hundred and twenty-seven unpaid volunteer leaders conducted the work in the local club groups in various communities throughout the State, under the supervision of a

permanent State club leader and 9 assistant club leaders employed on part time. The latter were paid cooperatively by the State college and the United States Department of Agriculture. One thousand three hundred and nineteen club groups were organized, with a total enrollment of 11,505 boys and girls; 50 per cent of the club groups and 40 per cent of the membership had been engaged in club work during the previous year. The 2,204 club members reported products to the value of \$57,179.31, produced at a cost of \$23,656.71. During the year the club leaders conducted 216 canning demonstrations, with a total attendance of 18,070 club members, women and men. Four hundred and forty-two field demonstrations, 48 club fairs and festivals, 27 leaders' training conferences, and 63 local, county, district, and State club exhibits were held. Club leaders during the year visited 4,813 club plats. One hundred and ninety-five thousand one hundred and ninety-eight copies of follow-up literature were sent to the club members by the State to assist them in their work.

The following table gives some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	50	34	13.2 acres.....	759½ bushels...	\$1, 103. 34	\$315. 41
Potato.....	175	159	29.1 acres.....	3,715½ bushels.....	3, 997. 90	1, 446. 18
Home garden.....	478	1, 203	14,230 square rods.	.....	16, 033. 47	6, 818. 94
Poultry.....	151	110	2,642 fowls.....	2,289 chicks, 2,403 dozen eggs.	3, 288. 95	1, 835. 19
Baby beef.....	7	5	7 animals.....	2,600 pounds.....	766. 50	214. 22
Pork and crop.....	97	99	517 animals.....	62,873 pounds.....	11, 219. 37	4, 807. 09
Sheep.....	31	25	89 animals.....	14,428 pounds.....	2, 198. 02	1, 276. 78
Rabbit.....	35	13	269 animals.....	.....	92. 10	69. 64
Home canning.....	222	434	.....	41,785 quarts.....	18, 116. 15	6, 791. 37
Garment.....	42	79	.....	78 articles.....	99. 67	33. 50
Flower.....	11	36	.....	137 kinds.....	144. 00	9. 99
Miscellaneous.....	20	7	.....	.....	119. 84	38. 40
Total.....	1, 319	2, 204	.....	.....	57, 179. 31	23, 656. 71

Total club enrollment, 11,505.

As a special war-emergency achievement, the mother-daughter canning clubs showed a total enrollment of 2,383 members, who reported having canned for home use 21,360½ quarts of fruit, 8,879 quarts of vegetables, 1,427 quarts of meats and soups, and 2,347 jars of jelly; and for sale, 5,312 quarts of fruit, 2,300 quarts of vegetables, and 260 glasses of jelly. The total value of these canned goods was \$18,116.15, at a total cost of \$6,791.37, thus yielding as a food conservation achievement, \$11,324.78 profit in canned products.

Farm-management demonstrations.—Work was conducted in 7 additional counties, making a total of 14 conducting farm-management demonstrations. Five hundred and twenty farmers began studying their business by keeping simple farm accounts. Some work was done teaching farmers the various items which must be figured in determining the cost of producing farm products. Special attention was devoted to farm practice such as trying to select more suitable crops for certain areas and helping increase production by adding new crops. As a result of farm-management demonstration work, 151 farmers changed the management of their business with the view of increasing their labor income.

Dairying and live stock.—This project was conducted by a leader and two field agents, one in eastern and one in western Washington, and is in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture. During the year, 6 new cow-testing associations were organized, 17 were reorganized, and a total of 13,100 cows were under test. As a result of these associations, about 10 per cent of the cows originally placed under test were found to be unprofitable and are being eliminated. One bull association with 72 members was completed during the year, and 10 bull clubs were organized and will later be consolidated into associations. Four cooperative cheese factories and 2 dairy associations were organized. One hundred and forty-one dairy and live-stock meetings were held with an attendance of 27,372, and 2,506 farm visits were made. A wool-demonstration car was operated in cooperation with the Bureau of Animal Industry, United States Department of Agriculture. A total of 18 stops were made and 4,455 people inspected the car. This brought together for conference the owners of over 300,000 sheep.

Poultry.—The direction of the poultry work of the boys' and girls' clubs engaged a large part of the time of the specialist. An important feature of the project was the conducting of the all Northwest egg-laying contest of 1,100 birds. This materially aided the poultry industry in the State by a comparison of strains and breeds, egg rations, care, etc. A joint home-economics and poultry-demonstration car was operated, in which instruction was given 9,958 persons at 22 meetings. Poultry talks and demonstrations were given at 85 meetings, with a total attendance of 4,900 people.

Soil management and crop production.—Farm demonstrations were conducted in seed selection and testing, soil management, liming the soil, land drainage, crop varieties, and smut treatment. One demonstration farm was operated successfully in Spagit County, the expenses being met by the farmer and the specialist acting as advisor.

OTHER EXTENSION WORK.

Markets and rural organization.—This project was started in February in cooperation with the Bureau of Markets, United States Department of Agriculture. Eight cooperative marketing associations were organized and as many more were discouraged. Three of these were organized for the primary purpose of securing better returns through the standardization of their products. One bulletin on the Bulk Handling of Grain on Washington Farms was issued, and investigations were made concerning public markets and the organization of a standard marketing association. In this work the specialist addressed 149 meetings, most of them arranged by the county agricultural agents.

SURVEY.

The organization of the extension division with a director and State leaders for the four principal phases of its work should result in increased efficiency. Appreciation of the leadership of the extension service was shown by the county-agent leader assisting in the organization of county councils of defense. The number of county agents doubled during the year and they made a fine record in stimulating larger crop production. The assistance they gave in the organization of cow-testing associations, breeders' associations, and farm-loan associations was particularly significant. Boys' and girls' club work made a good growth with the cooperation of the State department of education, but the percentage of members reporting was smaller than in the previous year. The inauguration of extension work in marketing met a very real need and promises large usefulness.

WISCONSIN.

Division of Agricultural Extension Service, College of Agriculture, University of Wisconsin, *Madison*.

H. L. RUSSELL, *Director*; K. L. HATCH, *Assistant Director*.

Organization and administration.—There was no change in the general organization of the extension work during the year. Very close cooperation existed with several of the State agricultural associations. The State dairyman's association and the State live-stock breeders' association gave financial assistance to cooperative extension work. The director and assistant director with the commissioner of agriculture were agricultural advisers to the State council of defense, and its agricultural activities were largely initiated by the extension division and carried out through the county agricultural

agents. The most rapid development in extension work was in the appointment of county agricultural agents. When war was declared 13 counties had agents, but by the end of the year agents were at work in 25 counties, and 6 other counties had provided for the support of agents. As soon as war was declared the college released members of its teaching staff to take up the work of emergency food agents in the various counties.

Publications.—To meet the conditions created by the war the college published 20 circulars, 9 posters, 4 stencil bulletins, and 8 miscellaneous pamphlets, with a total edition of 1,226,000 copies.

Finances.—The following funds were available for cooperative extension work in agriculture and home economies for the year ended June 30, 1917:

Smith-Lever, Federal	\$39, 635. 81
Smith-Lever, State	29, 635. 81
United States Department of Agriculture, farmers' cooperative demonstration work.....	11, 118. 33
Bureau of Animal Industry.....	1, 283. 33
College	13, 699. 47
County.....	19, 532. 16
Total	114, 904. 91

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, farm-management demonstrations, extension schools, drainage, soil management, plant diseases, land-clearing demonstrations, orchard management, dairy manufacturing, alfalfa demonstrations, weed control, potato demonstrations, live-stock demonstrations, and dairy-cow testing. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, boys' and girls' club work, farm-management demonstrations, and dairy-cow testing.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Counties with agents, June 30, 1916, 13; June 30, 1917, 22. Work was supervised by the county-agent leader.

Among the results of the activities during the year were the following: One thousand two hundred and eleven farmers selected their seed corn in the fall for 18,762 acres, and 1,675 farmers followed suggestions of agents in testing their seed corn for germination, resulting in 15,938 additional acres being planted with tested seed. Seed oats were treated for smut by 1,228 farmers for a total of 11,513 acres, and 1,013 farmers treated their seed potatoes for the control of potato diseases on 5,601 additional acres. The grow-

ing of more legumes was encouraged, resulting in 146 farmers sowing 419 acres of alfalfa and 221 farmers sowing 635 acres of soy beans.

Four hundred and seventeen farmers raised 4,074 acres of barley according to suggestion of agents. Wisconsin being one of the foremost dairy States, the agents devoted a great deal of time to live-stock improvement and the control of diseases affecting dairy cows. They assisted in organizing 18 cow-testing associations and 7 live-stock breeders' associations. Through the cow-testing associations 9,969 cows were under test, resulting in 383 being eliminated as unprofitable. Two hundred and forty-one registered bulls and 151 registered cows were secured, while 217 registered sires were transferred at suggestion of the agents. Three hundred and nine farmers adopted balanced rations for their herds. Two thousand eight hundred and thirty-nine cows were tested for tuberculosis.

In connection with a State-wide silo campaign a large number of demonstration meetings were held by the county and emergency demonstration agents, and as a result of the meetings held, the State-wide publicity given by the papers of the State, and the demonstrations conducted, it is estimated that 10,000 additional silos were built by the farmers of the State during the past year, bringing the total number of silos in the State to about 60,000 or about 1 for every 3 farmers. The agents report 1,228 silos which they know were built primarily at their suggestion. Ninety-nine drainage systems were planned and installed, bringing about the drainage of 11,315 acres. The agents tested soil for acidity on 688 farms and brought about the use of 1,574 additional tons of lime, and the plowing under of 5,575 acres of clover for green manuring. Two hundred and seventy four farm-analysis records were taken and 452 farmers were induced by agents to keep farm accounts. Thirty buying and selling associations and farmers' exchanges organized with the assistance of agents did more than \$500,000 worth of business, saving \$58,950 to the farmers. The agents conducted 1,288 demonstrations, involving 24,640 acres of crops and 4,057 live stock.

When war was declared the college of agriculture placed 27 emergency demonstration agents in counties to help stimulate food and live-stock production to meet the war needs. These men were drawn from the following sources: The agricultural college staff, normal-school instructors in agriculture, county agricultural-school instructors, farmers' institute force, and county superintendents of schools. The following quantities of seed grain were secured for farmers: Six thousand and eighty-four bushels of wheat, 6,159 bushels of oats, 2,487 bushels of buckwheat, 1,061 bushels of beans, and 10,012 bushels of rye. The oats acreage was increased by 4,906 acres, increasing the production 210,824 bushels, and 9,052 additional acres of wheat were sown. Assistance was given 3,299 farmers in se-

curing or locating 36,371 bushels of seed potatoes, with which 8,673 additional acres were planted and the production increased more than 500,000 bushels. As a result of the campaign for increased live-stock production 2,626 additional cows, 1,605 additional sows, and 8,145 additional sheep were bred. A special effort was made throughout the State to prevent heifer calves, which might be shipped to other States for breeding purposes, from being sold for veal. The agents report 2,459 heifer calves saved for breeding purposes through this campaign, which resulted in very desirable breeding stock being shipped to Oklahoma, Kansas, Iowa, North Dakota, Minnesota, Oregon, Illinois, Texas, Colorado, Montana, and Tennessee. Eighteen carloads of heifer calves less than a year old were shipped to Missouri farmers from one county alone. Twenty-one city markets, doing practically one-third of a million dollars worth of business, were established with assistance of agents. The agents assisted in organizing 27 farm-loan associations and in securing farm credit for 672 farmers. They assisted in placing 2,061 farm laborers. One hundred and ninety-six canning demonstrations were held for women, aside from club work, resulting in 16,275 additional quarts of fruit and vegetables being canned, and 5,243 farmers received information in regard to storing fruit and vegetables. The agents made 9,682 visits to farms, gave information to 26,007 persons at their offices, and took part in 1,564 meetings, attended by nearly 100,000 persons.

Home economics.—The principal line of home-economics extension work carried out during the fiscal year was a continuation of the extension schools previously organized to extend over a period of five years in succession without repeating the program in any locality. These schools continue for four days in each locality; three days are devoted to instruction in the study of foods and practical work in sewing. The fourth day is reserved for child welfare, the program being in charge of a local physician who gives lecture demonstrations to mothers and advice on cases of malnutrition. As follow-up work of the extension schools, study clubs were organized among farm girls and home-makers' clubs are organized for older women. Lectures were given before town and city clubs. Four district workers and one county agent were appointed after the emergency funds became available.

Boys' and girls' club work.—The boys' and girls' club work was under the direction of 2 club leaders, and was directly supervised by 235 unpaid volunteer leaders, who assisted in the work in their various local communities and whose supervision was responsible for 98 per cent of the results reported. Three hundred and thirteen club groups were organized, with a total enrollment of 26,260 club members, of whom 4,308 reported products to the value of \$121,303.14, produced at a total cost of \$52,757.41. Fifty-four per

cent of the members had done club work the preceding year. During the year, the club leaders conducted 85 canning demonstrations with a total attendance of 4,260 club members, women and children. There were also conducted 98 field demonstrations, 12 club fairs and festivals, and 189 local, county, district, and State club exhibits. The club leaders visited 64 club plats during the season, and a total of 47,535 pieces of follow-up literature were sent by the State to club members to assist them in their work.

The following table gives some of the more important results of the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plat or animals managed.	Product.		
				Amount.	Estimated value.	Estimated cost.
Corn.....	39	183	204 acres.....	11,785 bushels.	\$19,270.80	\$5,634.50
Potato.....	58	2,116	356.1 acres.....	43,195 bushels.	53,994.62	20,749.61
Navy bean.....	2	9	9 acres.....	98.7 bushels.	987.00	264.50
Poultry.....	45	811	851 fowls.....	8,710 chicks...	11,235.90	1,671.60
Baby beef.....		73	82 animals.....	62,890 pounds.	8,071.20	5,640.00
Pigs.....	15	142	164 pigs.....	29,257 pounds.	4,681.22	2,135.80
Calf.....	29	226	231 calves.....	310 jars jelly.	16,572.00	13,750.62
Canning.....	97	610		10,742 quarts.	6,407.60	2,873.52
Bread.....	28	138		828 loaves.....	\$2.80	37.26
Total.....	313	4,308			121,303.14	52,757.41

Total club enrollment, 26,260.

As a special war-emergency program to increase food production and food conservation, 3,283 boys and girls were enrolled who grew war gardens, each plat being not less than 2 square rods in size. There were also enrolled 14,862 club members, who were engaged in growing not less than 4 square rods each of some kind of grain or alfalfa; 110 club groups, consisting of 1,645 girls, engaged their time in making garments to help win the war.

Farm-management demonstrations.—Work was carried on by the county agents in 21 counties. As a result of their work 452 farmers were assisted in starting records of their business. Farm-analysis records were taken on 274 farms. Forty-five of these were summarized, returned, and personally discussed with the farmers.

Extension schools.—Extension schools, under the name of farmers' and women's weeks, were conducted under the plans detailed in the last report and continued to grow in influence and favor. A total of 24 one-week meetings for farmers and 18 for farm women were held during the year, attended by 28,000 people. This represented an increase of 28 per cent in number and 30 per cent in attendance over the previous year.

Drainage.—Tile drainage has now developed to such an extent in the southeastern part of the State that further demonstrations in this section do not appear necessary. Assistance was therefore given chiefly to the northern and central parts of the State. Work was undertaken on 63 farms, involving 51 preliminary surveys aggregating 2,700 acres, and 12 final surveys of 280 acres. Assistance was given to 42 organizations; in 12, preliminary surveys were made involving the improvement of 14,500 acres, and 26 field examinations of old and new organizations were made covering over 40,000 acres. Fifty meetings were held, with an attendance of 3,400, at which the drainage work in the immediate vicinity was discussed. Twenty-three follow-up demonstrations were given in the field, with an attendance of 350 farmers, to observe the benefits of tile drainage installed the previous year.

Soil-management demonstrations.—This project had the services of 3 men, 1 in the southern, 1 in the northwestern, and 1 in the northeastern part of the State. Emphasis was laid on the use of lime for alfalfa. The production of lime was taken up with the communities, the use of pulverized clamshells being developed in one section. Fertilizer demonstrations were carried on on a wide range of soil types. Although commercial fertilizers were unusually high, their use was profitable. On one demonstration 200 pounds of acid phosphate and 150 pounds of sulphate of potash increased the crop of potatoes from 258 to 396 bushels per acre, or 138 bushels, at a cost of \$11.28 per acre. In all, 64 demonstrations were held, with an attendance of 9,100 people.

Plant-disease control.—Emphasis was placed upon the development of disease-resistant varieties of plants, especially Wisconsin Hollander cabbage. Three hundred pounds of this seed was sold to 200 persons by the Wisconsin cabbage seed committee on the advice of the project leader. One field of 8 acres yielded 12 tons per acre, while the common variety yielded less than 1 ton per acre. Considerable work was also done in supplying disinfected seed potatoes to several of the county agents.

Land-cleaning demonstrations.—This work aroused widespread interest among the farmers and business interests of the northern part of the State; 30 demonstrations were conducted during the year, 16 of them lasting for a week. A demonstration train of 8 or 9 cars carrying land-cleaning equipment and workmen, stopped at each demonstration point from 1 to 4 days. Altogether about 8,000 people were interested in this work. The efficiency of hand and power-stump pullers and of low-grade dynamite were demonstrated. In many instances five or six farmers joined in the purchase of a machine to be used cooperatively, and whole communities united in the purchase of dynamite in car lots.

Orchard management.—The orchard work consisted of pruning and spraying. The specialist gave a lecture on pruning and then went to the orchard to demonstrate the points brought out in the lecture. Those who wished to learn to prune were divided up into sections of 10 to 15, and each section drilled by doing pruning day after day until the men could do it understandingly. A total of 160 men took this pruning course. A spraying school with a power sprayer in operation was handled the same way. Some work was done in drying fruits and vegetables. Some seed-potato certification was done on 49 farms growing 700 acres of potatoes.

Dairy manufacturing demonstrations.—A general campaign for the improvement of Wisconsin creamery butter and cheese was carried on, and 409 packages of butter, 391 samples of cream, and 63 cheeses were sent in for scoring. Assistance was given in the organization of 8 cooperative creameries and cheese factories, and accounting systems were established in 7 factories. During the year 16 different factories, many of which had been condemned, were visited and assisted in selecting new locations, making plans for factories, septic tanks, and ventilation. In one cheese factory there was a loss of \$3,000 from bloated cheese during the previous year, which was entirely eliminated during the past year by following suggestions made.

Alfalfa demonstrations.—This work was carried on in cooperation with the county agents in the organized counties and with what is known as the Alfalfa Order, a branch of the experiment association. Seed was distributed through these local orders, whose membership increased 25 per cent during the year.

Weed control.—Much of the work of this project was conducted in cleared-over land, where lumber camps had been instrumental in the growth of weeds. About 1,000 specimens were identified and seed sample cases were prepared for the public schools. Ninety-seven visits were made to farms to advise on weed control.

Potato-growing demonstrations.—About 15 demonstrations were given in potato cutting and seed treatment. Spraying demonstrations were conducted in three places. About 40 field meetings were held. Applications were received from 172 growers to have their fields of seed stock inspected for certification, and certificates were granted 82 growers certifying that their inspected stock was pure as to variety and free from disease.

Live-stock demonstrations.—The leader of this project worked in cooperation with the county agents, who arranged meetings at which live-stock matters were discussed, usually holding a series of three meetings in a county. The organizing of local community breeding associations was one of the principal lines of work. There are now

129 such organizations in the State, most of them being concerned with dairy cattle. Twenty-eight special sheep meetings were held principally on farms keeping sheep and greatly stimulated the sheep industry. In cooperation with the State live-stock breeders' association the production of baby beef was encouraged. Interest was first stimulated through a number of beef institutes, and these were followed by the organization of baby-beef contests for farm boys.

Dairy management.—The supervision of cow-testing associations was continued in cooperation with the State dairymen's association and the Bureau of Animal Industry of the United States Department of Agriculture. This embraces 81 cow-testing associations, with 40,000 cows on 2,417 farms; 37 new associations were formed during the year. During the month of August alone 101 cows were rejected and sold as "slackers." The work of the associations was given publicity by exhibits of the banner animals in the respective associations at the State fair and county fairs. Herd owners appreciated the increased price for which they were able to sell animals whose records had been kept by the associations. The field testers were also able to save the members thousands of dollars through better rations and the cooperative purchase of feeds. One association saved \$1,800 on its feed bill, most of the purchases being made through local dealers on a commission basis.

OTHER EXTENSION WORK.

Crop-production demonstration.—This project was carried on principally through the State experiment association which now has 2,000 members and organizations in 56 counties, and receives a State appropriation of \$5,000 for its work. The demonstrations were conducted principally on 62 public farms on which an annual round-up is held for observation and comparison of the varieties grown. One variety of oats which has been bred for 18 years was distributed to farmers in small lots and gives an average yield of 25 bushels per acre more than the ordinary varieties. It is estimated that 96 per cent of the barley in Wisconsin is the progeny of one seed planted 18 years ago. The seed has been distributed chiefly through this association. The rye acreage was increased about 20 per cent, mostly on newly cleared lands. The improvement of hemp has been stressed in recent years, and as a result: Two thousand acres were grown in 1915, and 3,000 to 4,000 in 1916, and 8,000 acres were grown in 1917. About four years ago the distribution was commenced of two pedigreed varieties of winter wheat, which had been proven to be unusually productive in numerous tests. Increased production per acre is now an important means of increasing the wheat production of the State. About 4,000 bushels of seed of these varieties suitable for seed were found among less than 60 growers. In order to multiply

this pure-bred wheat as rapidly as possible, the Wisconsin bankers' association distributed it through their local bankers, so that it was placed in the hands of careful farmers who will keep it pure and have agreed to save it for seed purposes.

Farmers' institutes.—The activities of the farmers' institutes have been more widely extended and specialized this year than ever before. Besides the regular 2-day institutes, of which 126 were held with an aggregate attendance of 63,770 people, 53 women's meetings and 17 one-day institutes have been carried on. Special feature institutes embracing the consideration of problems incident to the light sandy soils in the central part of the State, drainage, live stock, and cow-testing meetings, have been found to be of particular value. They focus the attention of the community on a single problem chosen to meet a real need of that section, and more definite results are thus secured. In all, 403 meetings of various types, with an attendance of 108,700, have been held.

SURVEY.

The agricultural activities of the State council of defense were carried out through the county agents, the director and assistant director of the agricultural extension service being agricultural advisers of the council. Appreciation of the work of the extension service is shown by the financial support given it by the agricultural associations of the State. The number of counties with county agents doubled during the year, and emergency demonstration agents were placed in most of the other agricultural counties after the declaration of war. The State-wide silo campaign resulting in a large increase of silos and a consequent saving of small grains, the establishment of city markets, and the saving of pure-bred heifer calves, which were shipped to other States, were notable achievements of the county agents. Home-economics work was done chiefly through extension schools, though plans for starting home-demonstration work were made at the end of the year. Following up extension schools with the organization of home-study clubs for girls and homemakers' clubs for women, is a means of measuring the success of the schools and of conserving their influence. Membership in boys' and girls' clubs was largely increased through emergency members and the value of the products was quadrupled. The small proportion of members reporting, and the fact that practically all reporting were under the supervision of volunteer leaders, indicates the desirability of a further establishment of local leadership. The demonstrations in land clearing have been particularly successful and are a unique example of the adaptation of extension methods. The use of the laboratory method in orchard demonstrations of pruning and spray-

ing is of interest to extension specialists in horticulture. The wide dissemination of seed of improved varieties of grains through cooperation with the State experiment association and local bankers was an important war measure to secure greater production per acre.

WYOMING.

Division of Extension Work, College of Agriculture, University of Wyoming,
Laramie.

A. E. BOWMAN, *Director.*

Organization and administration.—There has been no material change in the general organization of the division of extension. A closer cooperation is being developed with the State department of public instruction particularly with regard to boys' and girls' club work. County home-demonstration work was started at the close of the year. Much of the work planned by the extension specialists and county agents prior to the war was discontinued, because it was of a nature to require considerable time for completion, and it was felt that it was more important to give attention to projects involving the immediate increased production and conservation of food.

Publications.—During the year 35 circulars for boys' and girls' club work and 7 other circulars were published, with a total edition of 43,000 copies. The Wyoming Farm Bulletin was also published monthly, dealing with all phases of the extension work. It was sent free to all residents of the State applying for it, and went to a mailing list of 11,000 names.

Finances.—The following funds were available for cooperative extension work in agriculture and home economics for the year ended June 30, 1917:

Smith-Lever, Federal	\$12, 290. 20
Smith-Lever, State	2, 290. 20
United States Department of Agriculture, farmers' cooperative demonstration work	8, 530. 21
Bureau of Biological Survey	750. 00
Bureau of Animal Industry	1, 500. 00
State appropriations	22, 573. 73
County	8, 299. 55
Other sources within the State	525. 00
Total	56, 758. 89

Smith-Lever funds were used in support of the following projects: Administration, county-agent work, home economics, boys' and girls' club work, extension schools, and dairying. Funds from the United States Department of Agriculture were used in support of the following projects: County-agent work, boys' and girls' club work, dairying, and control of mammal pests.

A detailed statement of expenditures and receipts has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—County agents June 30, 1916, 8; June 30, 1917, 13. The work was supervised by the county-agent leader.

Among the results of the work during 1917 were the following: Six hundred and thirty-one farmers followed suggestions of agents in treating seed oats for smut, resulting in 12,196 additional acres being sown with treated seed; 253 farmers treated their seed potatoes for the control of potato diseases for 5,221 acres; and 86 farmers raised 1,327 acres of sweet clover as recommended. Increased live-stock production and live-stock improvement were encouraged, one cow-testing association being organized, bringing 393 cows under test. The agents assisted in organizing five live-stock breeders' associations and in having 400 cows brought in from Wisconsin, which were fed and housed according to suggestions of agents. In order to demonstrate the control of blackleg, 25,440 calves were vaccinated with the assistance of agents. Thirty-four irrigation systems were planned and installed, bringing about the irrigation of 2,481 acres. Through the farmers' cooperative buying and selling associations and exchanges, \$249,000 worth of business was done, saving more than \$12,000 to the farmers. The agents conducted 278 demonstrations involving 32,694 acres of crops and 6,790 head of live stock.

In addition to the above work, the agents carried on definite campaigns to increase crop and live-stock production to meet the war needs. Eight hundred and three farmers were assisted in securing or locating 29,865 bushels of seed wheat. The wheat acreage was increased by 19,685 acres, thereby increasing the production more than one-third of a million bushels. The agents also assisted the farmers in securing 6,984 bushels of seed oats, 2,246 bushels of seed corn, 13,576 bushels of seed potatoes, 2,957 bushels of seed beans, and 7,170 bushels of seed rye. The corn acreage was increased by 5,100 acres, increasing the production 153,750 bushels. The potato acreage was increased by 4,915 acres, increasing production more than 500,000 bushels. The bean acreage was increased by 9,382 acres, increasing the production 69,315 bushels. The agents received 1,340 applications from farmers for farm help and placed 1,287 men. As a result of the campaign for increased live-stock production, 10,450 additional sheep were raised or placed on farms and 5,010 additional hogs were raised. Five hundred and ninety horses were located for the War Department. Two hundred and eighteen farm tractors were rented or loaned to farmers through county agents' offices, and

9,525 additional acres were cultivated, due to the tractor campaign. The agents assisted in organizing 39 farm-loan associations. One hundred canning demonstrations were arranged for, resulting in 172,300 additional quarts of fruit and vegetables being canned; 3,550 persons were given assistance in home gardening, and 3,424 farmers received information regarding storing of fruits and vegetables.

In doing the above work the agents made 4,442 visits to farms, gave information to 6,881 persons at their offices, and took part in 563 meetings attended by 24,560 persons. One farm bureau was organized during the year and there was considerable interest in extending farm-bureau organization to other counties.

Home economics.—During the past year special attention was given to such lines of work as would form the basis for the permanent county organization of home-demonstration work. Thirty home economics study clubs were formed to secure immediate results and to promote permanent county work. Seven thousand homes adopted suggestions and 60 home demonstrations were given. One hundred and twenty-two meetings were held, with a total attendance of 14,000. Special emphasis has been given to clothing and home-nursing projects. In one county it was reported that \$3,000 were saved in remade clothing. Twenty bulletins were issued for use in the study clubs. In cooperation with the State council of defense, 116 conservation meetings were held in 19 counties, with an attendance of 3,075 women. After the emergency bill was passed, home-demonstration agents were placed in three counties. A State demonstrator was added to the State staff to work in the counties where no home-demonstration agent was employed.

Boys' and girls' club work.—The boys' and girls' club work was conducted by a State leader and nine assistant State leaders employed on part time, with the cooperation of county school superintendents, county school commissioners, school teachers and school supervisors. Ninety-seven persons volunteered their time in the various communities in assisting the club work. Ninety-five clubs were organized, with a total enrollment of 1,083 members who reported products to the value of \$12,678.14, produced at a total cost of \$2,249.24. Thirty-five per cent of the club groups were in club work during the preceding year. During the year club leaders conducted 80 canning demonstrations, with a total attendance of 890 club members, women and men. Fifty-three field demonstrations, 9 club fairs and festivals, and 16 local, county, and State club exhibits were held. In addition to this the leaders visited 2,150 club plats during the season and caused 14,000 copies of club literature to be sent to club members.

The following table gives some of the more important items regarding the club work:

Summary of completed projects of boys' and girls' clubs.

Project of work.	Clubs organized.	Members reporting results.	Plats or animals managed.	Products.		
				Amount.	Estimated value.	Estimated cost.
Poultry.....	6	55	2,329 fowls.....	2,076 chicks....	\$1,071.06	\$340.01
Pork and crop.....	8	78	78 pigs.....	7,423 pounds...	3,260.86	564.59
Canning.....	26	199	.....	7,054 quarts, 1,328 jars jelly	6,805.83	773.72
Garment.....	28	88	.....	264 garments...	1,314.69	438.24
Hackamore.....	27	42	.....	351 hacka- mores.	225.70	132.64
Total.....	95	462	.....	.....	12,678.14	2,249.24

Total club enrollment, 1,083.

Dairying.—The work of this project is intended to stimulate the development of the dairy industry in the State. One new cow-testing association was organized, involving 30 herds of 440 cows. Seven farmers were assisted in keeping herd records and 3 in remodeling barns. Seventeen silos were built, and there was an increase of 100 per cent in the number of silos in the State. Over 800 dairy cattle were purchased in Wisconsin for farmers of the State. Considerable work has been done assisting creameries with their problems. One creamery and 1 cheese factory were organized. During the year 147 meetings were addressed, with a total attendance of 6,191, and 329 farmers adopted suggestions of the extension worker.

Extension schools.—Five sessions were held during the year, with an attendance of 425.

Farmers' institutes.—Sixty-six institutes, with a total of 156 sessions, attended by 6,816 people, were held during the year. As much time as possible was given to practical demonstrations.

SURVEY.

The first farm bureau was organized and lively interest in this type of organization developed in other counties. The program of work of the county agents was necessarily revised to meet the more pressing problems incidental to the war, and resulted in a very considerable increase of food production. Many home-economics clubs were organized as a basis for permanent county work for farm women, and the home-economics leaders directed the program of the State council of defense for food conservation in the home. Membership in boys' and girls' clubs doubled, and a much larger proportion completed the year's work, doubtless on account of the considerable increase of local leadership. The importation of pure-bred dairy cattle through the efforts of the county agents was a permanent service to the dairy industry of the State.



FARMERS' INSTITUTES IN THE UNITED STATES IN 1917.

By J. M. STEDMAN, *Farmers' Institute Specialist.*

INTRODUCTION.

During the fiscal year ended June 30, 1917, farmers' institutes were officially in charge of the extension division of the agricultural colleges in 31 States, while in the remaining 17 States they were still in charge of the State government itself. Recently two of the latter States, Maryland and New York, transferred their farmers' institute activities to the agricultural college.

Farmers' institutes in the United States, however, are not rapidly decreasing, as is shown by the number of sessions and their attendance. This is surprising, in view of the fact that before the agricultural colleges organized extension divisions the State farmers' institutes included women's institutes, young people's institutes, railroad instruction trains, movable schools, and other activities which are not regarded as farmers' institutes by the agricultural colleges. Furthermore, these activities have been almost entirely abandoned by the State farmers' institutes, since they are provided for in the Smith-Lever Act, which makes generous provision for these activities through the extension divisions of our agricultural colleges.

GENERAL STATISTICS OF FARMERS' INSTITUTES.

Of the 31 States in which farmers' institutes were officially in charge of the extension division of the agricultural colleges, one (New Mexico) has not reported and eight (Arizona, Arkansas, Kentucky, Mississippi, Oklahoma, Oregon, South Carolina, and Washington) did not hold farmers' institutes. The 22 States reporting as having conducted farmers' institutes held in all 3,958 institutes, lasting 5,471 days, with a total of 11,348 sessions, at which 1,389,553 people were in attendance. The extension divisions employed 966 lecturers in the farmers' institute work, of which number 447 were not on the extension staff. State funds to the amount of \$132,290.55 and other funds aggregating \$84,186.46 were used in conducting the institutes.

Of the 17 States directly in official charge of farmers' institutes two (Vermont and Virginia) have not reported and one (Maine)

did not have data available. The 14 States submitting data held a total of 3,034 farmers' institutes, lasting 3,965 days, embracing 7,504 sessions, with an attendance of 997,377. These States employed 454 lecturers, of which number 177 were from the agricultural colleges and experiment stations. The total State appropriation for farmers' institute work was \$120,006.11, while funds from other sources were used to the amount of \$43,588.81.

The entire farmers' institute work in the United States during 1917, as compiled from 34 States reporting as having held farmers' institutes, consisted of 6,992 institutes, which lasted 9,436 days, comprised 18,852 sessions, had an attendance of 2,387,928, employed 1,420 lecturers, and cost \$380,071.93, which was divided between State appropriations of \$252,296.66 and other funds contributed to the amount of \$127,775.27.

More detailed information respecting the farmers' institute work in each State may be obtained by inspecting the tables accompanying this report.

THE DIVISION OF FARMERS' INSTITUTES.

This division of the States Relations Service continued to aid all farmers' institute workers, as well as county agricultural agents and other extension teachers throughout the entire country along the same lines as heretofore. Progress was made during the year in the preparation and publication of new syllabi of lectures with excellent lantern slides, each with a teaching value. All lantern slides are now being colored whenever it adds to the teaching value. The lectures were used not only by farmers' institute workers, but more especially by county agents, who are making increased requests for their use. They are also used by extension teachers in agricultural colleges, by teachers of agriculture in high schools, by grange lecturers, boards of health, and various other persons who desire aid in presenting their subject before audiences of farmers.

Seven new lectures were published during the year, namely, "Leguminous Forage Crops for the South," "Leguminous Forage Crops for the North," "Sweet Potatoes: Culture and Storage," "The Farm Vegetable Garden," "Practical Improvement of Farm Grounds," "Public Road Improvement," and "Cow Testing and Dairy Records."

AGRICULTURAL EXTENSION WORK IN FOREIGN COUNTRIES.

Owing to the European war, all agricultural extension work in Europe has either ceased entirely, or, if conducted at all, has not been reported in any of the foreign publications.

STATISTICS.

Farmers' institutes conducted by the States, year ending June 30, 1917.

State.	Number of institutes.	Total number of days of institutes.	Total number of sessions.	Total attendance.	Number of lecturers.			Amount of State appropriation used for institutes.	Other funds used.
					From official State institute staff.	From agricultural college or experiment station staff.	Total number.		
Alabama.....	13	19	68	1,371	.....	6	6	\$600.00	.....
Delaware.....	22	35	89	12,514	6	4	10	1,400.00	.....
Illinois.....	287	431	1,027	188,980	74	41	115	22,353.46	\$10,020.00
Iowa.....	129	480	1,116	224,461	.....	.....	.....	7,213.79	33,568.81
Maryland.....	83	.....	166	15,000	9	8	17	6,000.00	.....
Massachusetts.....	107	107	122	9,116	37	14	67	2,434.88	.....
Missouri.....	504	749	749	173,413	4	8	12	12,500.00	.....
New Hampshire.....	22	22	44	1,320	0	8	17	2,000.00	.....
New Jersey.....	78	86	198	14,820	18	29	47	3,255.07	.....
New York.....	362	376	1,417	63,979	17	12	29	20,502.00	.....
North Carolina.....	158	160	326	39,766	6	10	16	6,500.00	.....
Pennsylvania.....	224	433	1,069	172,759	37	19	56	20,000.00	.....
Rhode Island.....	58	59	62	4,726	30	18	48	753.54	.....
Texas.....	987	1,008	1,051	75,152	6	.....	14	14,493.37	.....
Total.....	3,034	3,965	7,504	997,377	253	177	454	120,006.11	43,588.81

No data available for Maine; no report received from Vermont and Virginia.

Farmers' institutes conducted by the extension departments of the agricultural colleges, year ending June 30, 1917.

State.	Number of institutes.	Total number of days of institutes.	Total number of sessions.	Total attendance.	Number of lecturers.			Amount of State appropriation used for farmers' institutes.	Other funds used.
					From extension staff.	From outside sources.	Total number.		
California.....	740	745	785	50,259	8	55	63	\$4,000.00	.....
Colorado.....	15	30	95	19,672	17	8	25	600.00	.....
Connecticut.....	31	31	58	1,669	15	22	37	461.25	.....
Florida.....	117	89	168	17,887	51	57	108	10,000.00	.....
Georgia.....	96	96	192	17,829	24	.....	24	2,500.00	.....
Idaho.....	36	40	82	3,600	7	6	13	.....	.....
Indiana.....	516	661	1,528	262,410	5	36	41	12,362.02	\$7,134.21
Kansas.....	327	450	857	72,638	23	9	32	9,330.91	2,136.20
Louisiana.....	77	80	164	14,161	20	10	30	.....	.....
Michigan.....	470	535	1,268	138,806	35	30	65	9,282.57	.....
Minnesota.....	73	95	190	26,544	.....	11	11	4,132.56	.....
Montana.....	109	109	137	31,425	45	16	61	10,000.00	.....
Nebraska.....	121	239	325	36,792	30	15	45	5,000.00	47,000.00
Nevada.....	9	19	35	2,240	5	16	21	100.00	50.00
North Dakota.....	81	101	153	14,772	5	6	11	4,574.21	515.00
Ohio.....	423	546	2,115	415,185	2	46	48	14,803.05	12,494.36
South Dakota.....	69	224	635	35,923	7	9	16	4,948.30	4,836.69
Tennessee.....	3	9	30	7,500	23	52	75	4,471.78	.....
Utah.....	101	183	660	71,375	97	34	131	10,000.00	.....
West Virginia.....	144	239	588	49,250	15	13	28	5,020.68	.....
Wisconsin.....	334	576	1,127	92,708	40	30	70	20,000.00	.....
Wyoming.....	66	74	156	6,816	3	8	11	703.21	.....
Total.....	3,958	5,471	11,348	1,389,553	477	489	966	132,290.55	84,186.45

No institute held in Arizona; no report received from Arkansas, Kentucky, Mississippi, New Mexico, Oklahoma, Oregon, South Carolina, and Washington.

Expenditures for cooperative agricultural extension work for the year ended June 30, 1917, by items of expense.

EXPENDITURES FROM THE UNITED STATES APPROPRIATION OF MAY 8, 1914 (FEDERAL SMITH-LEVER).

State.	Amount of appropriation.	Salary.	Labor.	Publications.	Stationery and small printing.	Postage, telegraph, telephone, freight, and express.	Heat, light, water, and power.	Supplies.	Library.	Tools, machinery, and appliances.	Furniture and fixtures.	Scientific apparatus and specimens.	Live stock.	Traveling expenses.	Contingent expenses.	Unexpended balance.
Alabama.....	\$19,401.67	\$31,652.76	\$1,631.01	\$2,613.16	\$1,433.35	\$606.04	\$169.43	\$379.20	\$51.82	\$134.34	\$586.36	\$126.22		\$10,011.43	\$6.56	
Arizona.....	13,145.03	7,253.11	90.25	638.40	427.35	162.57	165.35	165.35		8.50	463.91	131.25		3,754.24	20.00	
Arkansas.....	20,553.89	26,553.89	410.06	1,443.91	780.77	433.77	47.90	138.68	13.00	18.20	824.25			3,824.89	82.66	
California.....	30,235.33	20,646.19	223.98	979.45	548.70	210.24		461.93	4.50	47.76	608.08	26.75		6,455.75	42.00	
Colorado.....	18,786.47	14,312.24	238.80	705.99	261.38	317.30	2.00	106.80		5.76	140.45			2,695.69		
Connecticut.....	12,661.53	9,227.06	184.22			47.79		212.87						2,972.59		
Delaware.....	12,345.76	8,447.04	73.40	9.50	407.42	182.03	9.72	99.87		45.09	213.39	11.20		2,715.41	19.50	
Florida.....	26,151.36	14,225.89	93.50	47.53	459.88	58.67		49.22			228.87			6,728.17		
Georgia.....	1,272.15	36,027.09	1,272.15		1,235.47	1,406.21	737.91	2,371.43	4.75	160.22	838.84	244.73	\$48.00	11,804.56		
Idaho.....	15,699.51	7,731.41	819.00	230.65	608.89	345.65	1.20	76.41	11.35	472.53	574.11	223.19		4,496.90	48.25	
Illinois.....	58,184.03	49,314.03	350.34	2,606.23	1,153.73	410.75	5.25	354.25	36.24	1,049.12	469.20	64.25		2,370.64		
Indiana.....	44,706.87	32,091.88	251.38	734.09	1,332.48	201.98		295.22		86.44	233.20	117.07		9,363.13		
Iowa.....	44,432.16	42,006.00	455.00	1,971.16												
Kansas.....	36,685.00	30,397.51	61.80	1.50	169.36			1,034.91	3.70	15.50	32.74	230.30	22.35	4,480.45	234.88	
Kentucky.....	48,661.65	27,043.30	380.92	1,288.67	626.13			580.93	89.35	55.10	520.30	7.20		12,465.41	300.85	\$4,930.50
Louisiana.....	35,853.87	30,552.10	17.00	1,902.64	45.00	186.61		930.20			74.50			2,145.82		
Maine.....	18,045.18	11,688.25	302.27	421.13	1,626.56	114.04	80	183.21	113.85	302.87	393.33	292.30		2,602.17	2.40	
Maryland.....	24,202.34	14,069.94	47.27	832.69	789.63	396.79	19.00	536.39	24.48	509.33	1,088.63	31.00		5,081.97	175.00	
Massachusetts.....	15,373.04	9,730.37	56.53	767.78	68.92	160.56	.15	77.35		5.62	1.75			4,504.01		
Michigan.....	43,059.35	43,059.35														
Minnesota.....	37,314.81	28,712.45	7.90	237.71	60.13	147.42		84.73	3.75	19.15	96.30			8,149.17	10.10	
Mississippi.....	45,437.14	31,144.90	739.81	1,323.78	1,323.78	191.45	113.15	71.20	1.60	113.06	2,148.49	5.00		7,241.67	170.00	
Missouri.....	52,229.32	30,539.79	1,587.70	2,371.37	3,047.38	1,429.13		1,363.19	58.54	41.12	1,972.41	177.20		9,651.49		
Montana.....	15,406.35	12,650.34	386.35	553.09	331.59	104.26		65.70			555.35			752.67		
Nebraska.....	29,645.80	19,418.09	392.43	791.11	1,497.83	505.80		859.68	108.00	276.94	128.31	36.61		5,018.96	12.64	
Nevada.....	11,527.06	8,212.77	192.10	76.80	274.01	92.36		139.35	15.75	138.43	701.30	441.90		1,872.09		
New Hampshire.....	13,041.91	10,342.12	117.60	22.75	218.78	151.20		142.72	2.18	3.38	88.18			2,822.43		
New Jersey.....	24,041.91	13,071.39	749.40	1,094.49	957.59	537.86		603.54	9.52	191.83	695.90	208.00		2,858.06	115.32	8.92
New Mexico.....	16,257.54	8,547.90	51.13	797.95	859.39	441.36		117.51	36.05	40.83	874.87	23.75		4,495.00	1.80	
New York.....	52,978.82	38,661.12	2,270.49	515.55	1,640.61	649.08	2.50	744.55	67.50	164.95	1,059.06	220.68		7,032.23		
North Carolina.....	21,079.86	38,614.84					6.80	540.59	163.07	77.43	697.35	121.36		6,464.30		
North Dakota.....	21,453.18	20,294.37		1,528.61		813.74								1,198.81		
Ohio.....	50,553.66	31,268.03	459.20	2,687.23	2,123.32	1,655.78		1,123.13		1,954.09	1,659.68	389.38		13,525.30	7.00	1.52
Oklahoma.....	39,892.10	34,393.56	33.85	1,281.67	222.50	107.88		15.94	18.50		135.00			3,627.69		.51
Oregon.....	18,151.66	9,819.99	647.60	9.16	162.76	226.01		607.23						5,706.88		
Pennsylvania.....	77,638.51	63,041.41	372.60	2,276.28	924.19	992.55		362.22			301.25	111.50		8,739.55	6.00	

Expenditures for cooperative agricultural extension work for the year ended June 30, 1917, by items of expense—Continued.

EXPENDITURES FROM THE UNITED STATES APPROPRIATION OF MAY 8, 1914 (STATE SMITH-LEVER).

State.	Amount of appropriation.	Salary.	Labor.	Publications.	Stationery and small printing.	Postage, telegraph, telephone, freight, and express.	Heat, light, water, and power.	Supplies.	Library.	Tools, machinery, and appliances.	Furniture and fixtures.	Scientific apparatus and specimens.	Live stock.	Traveling expenses.	Continued expenses.	Unexpended balance.
Alabama.....	\$39,401.67	\$36,648.24	\$564.24		\$449.03	\$425.86		\$280.89	\$14.63		\$37.30			\$981.48		
Arizona.....	3,145.03	2,291.03	1.00	\$172.00	129.03			9.83			88.00			431.47		
Arkansas.....	30,577.08	26,209.17	72.00	1,566.95	1,314.45	347.76	\$114.10	84.48	4.00	\$8.40	\$52.17			6.00		
California.....	20,235.33	12,819.43	26.50	339.25	333.86	204.37		191.72	2.50	91.80	82.02			5,938.68	\$3.00	
Colorado.....	8,786.47	3,681.35	646.36	275.46	323.37	294.74		117.33	22.00	1.55	500.62	\$9.30		2,908.59		
Connecticut.....	2,361.53	1,994.33	1.00			17.37		8.45		.65				539.23		
Delaware.....	2,345.76	1,744.13	6.75		15.50	26.05		34.49			251.00			518.84		
Florida.....	11,892.73	9,180.48	36.00	1,000.81	192.10	52.40		53.05		42.73	297.65	57.80		526.89		
Georgia.....	46,151.36	32,064.84	157.50	5,000.00	62.50	5.99		75.83	11.20	1.35	234.47	27.35		8,375.32	3.00	
Idaho.....	5,639.54	3,290.83	152.95		548.00	203.77		8.15						1,229.67		
Illinois.....	48,184.03	48,184.03														
Indiana.....	34,706.87	34,706.87														
Iowa.....	34,432.16	29,741.80	2,967.34	1,639.65				72.37			53.37			5,113.83	10.00	
Kansas.....	26,685.00	21,099.80	153.32			130.02					100.00			54.70	2.30	\$4,930.50
Kentucky.....	38,661.65	33,095.22	255.69			323.24								11,845.51		
Louisiana.....	25,843.17	12,444.06	8.35		16.50	367.44		1,086.51	5.00		85.50			4,267.19	.45	
Maine.....	8,045.18	2,239.96	80.16		593.51	257.08	8.80	137.15	61.53	43.98	396.65	.25		1,029.25		
Maryland.....	14,202.34	10,564.38	55.70	1,080.31	175.74	23.99		224.25		423.90	473.90	83.39		733.93		
Massachusetts.....	3,373.01	4,593.90				19.91		3.30						13,498.98	.75	
Michigan.....	33,039.35	10,943.35	3,250.18	1,529.21	1,910.60	668.43		308.64		129.56	536.94	222.71		228.66		
Minnesota.....	27,314.81	21,706.66	6.30	1,888.97	556.77	412.77		103.98		18.00	179.55	202.95		3,620.60	125.37	
Mississippi.....	35,437.14	29,919.05	833.00		243.86	87.80		364.44		17.99	224.83			7,580.97		
Missouri.....	42,229.32	25,904.65	1,832.02	2,291.50	1,004.16	972.05		993.18	2.91	186.18	713.95	171.75		3,131.32		
Montana.....	5,408.35	5,408.35												670.73		
Nebraska.....	19,645.80	11,074.44	142.50	698.23	1,303.97	732.90		450.07	45.00	480.60	874.54			865.21		
Nevada.....	1,527.06	185.74	18.00	10.00	245.58	37.71		169.29		84.70	64.50	40.81				
New Hampshire.....	3,911.34	2,641.99	78.70	2.75	220.46	25.53		39.95			36.75					
New Jersey.....	14,041.91	14,041.91														
New Mexico.....	6,257.54	4,064.29	31.15			32.33		12.55	1.44		5.00	164.50		1,915.13		
New York.....	42,978.32	42,968.69				9.63								5,409.16	87.00	
North Carolina.....	42,079.85	29,723.16	397.83	2,353.50	1,081.79	1,096.70	5.30	883.83	75.92	243.97	669.20	52.50		1,029.45		
North Dakota.....	11,453.18	10,423.73												7,730.23	69.35	1.52
Ohio.....	46,833.66	37,590.64	173.54		312.87	256.38		38.27		2.50	421.68	230.68		4,099.16		.51
Oklahoma.....	29,802.10	21,083.80	462.60	1,390.00	1,944.27	3.10		216.94	1.60		1,026.23			1,037.66		
Oregon.....	8,151.66	6,180.95	157.95	323.97	118.20	183.55		54.10		14.97	28.23	47.00		23,317.89	366.61	
Pennsylvania.....	67,638.54	24,027.29	1,257.53	4,254.96	3,971.32	3,780.81	72.69	1,790.56	37.03	443.77	2,667.37	650.71				

Rhode Island.....	400.24	326.67	5.15	16.75	28.06	1.72	4.59	8.10	
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Rhode Island.....	10,800.48	8,370.94	13.00	71.25	336.32	39.89	26.10	34.96	9.79	.60	9.49	1,886.00	25	
South Carolina.....	67,534.22	54,433.33	338.02	1,544.16	372.33	408.92	214.82	21.00	.....	434.94	.....	9,687.40	72.00
South Dakota.....	32,611.92	19,239.96	2,190.00	18.24	769.64	594.76	354.33	20.10	155.89	891.97	30.00	8,407.03	.....
Tennessee.....	87,737.04	56,139.24	1,606.92	4,291.74	3,897.69	1,160.06	567.93	114.43	242.90	2,031.86	59.66	17,447.27	5.03	
Texas.....	141,888.78	90,695.32	67.73	6,689.01	2,697.80	1,805.73	782.74	126.15	.....	1,204.12	93.72	37,718.12	8.34
Utah.....	18,494.70	12,529.92	479.47	339.92	253.10	279.60	182.57	11.97	.....	1,397.74	.....	4,456.16	27.00
Vermont.....	18,337.14	12,570.01	820.21	382.52	590.40	425.77	415.24	10.23	111.21	60.90	4.70	2,933.48	12.47	
Virginia.....	80,663.86	63,238.72	56.75	1,642.27	990.86	624.49	355.32	159.23	99.78	2,044.27	121.33	11,204.11	52.16	
Washington.....	33,915.68	19,536.49	1,241.59	1,025.11	1,883.82	588.02	412.93	1.50	69.55	241.27	.....	8,915.40	.....
West Virginia.....	54,263.09	44,114.26	1.50	.....	480.08	28.70	160.60	.....	161.70	104.37	.....	9,211.70	.....
Wisconsin.....	69,271.62	46,109.34	2,567.22	1,421.30	390.27	643.40	231.00	20.10	.....	36.34	214.28	16,528.86	27.00
Wyoming.....	14,580.40	9,150.57	81.50	587.35	346.62	291.35	139.20	.....	47.35	131.10	70.23	3,735.13	.....
Total, 1917.....	2,680,000.00	1,926,003.38	99,063.52	78,750.09	57,496.35	32,483.47	1,571,492.27	598.83	1,493.93	9,454.87	37,072.46	5,805.05	70,354,012.30	231.85
1916.....	1,680,000.00	1,183,423.36	27,213.28	43,066.11	39,532.77	17,552.00	1,191,912.22	836.31	1,511.73	11,416.11	132,765.51	3,416.57	52,732,881,122.47	1,716.58
1915.....	480,000.00	322,631.44	6,511.70	8,241.16	9,270.05	5,539.85	146.85	6,193.34	304.56	1,733.53	13,131.40	2,431.69	162.34	36,402.11

Expenditures for cooperative agricultural extension for the year ended June 30, 1917, by projects.

EXPENDITURES FROM THE UNITED STATES APPROPRIATION OF MAY 8, 1914 (FEDERAL SMITH-LEVER).

State.	Total.	Adminis- tration.	Printing and dis- tribution of publi- cations.	County agent.	Home eco- nomics.	Extension schools.	Boys' clubs.	Pig clubs.	Poultry clubs.	Animal hus- bandry.	Poultry.	Dairying.	Animal diseases.
Alabama.....	\$49,401.67	\$5,617.05	\$2,613.16	\$11,745.05	\$13,582.80	\$1,809.74	\$550.00	\$660.13	\$1,719.12	\$1,103.08		\$1,423.75	
Arizona.....	13,145.03	6,265.26	638.40	1,476.50	535.05	408.60	1,221.27			2,432.71			
Arkansas.....	40,577.08	8,441.79	1,443.91	13,435.08	6,282.58			377.19		119.38			
California.....	30,235.33	5,571.47	979.45	17,032.96	3,727.20		2,284.25						
Colorado.....	18,786.47	6,119.20	705.99	6,229.85	1,341.54		1,506.56			2,074.05			
Connecticut.....	12,561.53	1,638.36		4,110.57			2,438.99					1,900.33	
Delaware.....	12,345.76	2,753.26	9.50	5,557.46			250.00					1,021.16	
Florida.....	21,892.73	1,240.39	47.53	5,401.03			3,541.96			301.13			
Georgia.....	56,151.36	18,162.03		9,915.00	11,661.80	3,215.48	1,604.71	901.01	1,020.62	3,377.27			
Idaho.....	15,699.94	3,556.81	230.63	5,393.83	1,310.40	853.69	1,102.16			1,285.72			
Illinois.....	58,184.03	3,087.76	2,606.23	27,744.19	11,428.47	1,889.84	5,544.19			4,358.16		2,636.43	
Indiana.....	44,706.87	4,263.90	734.09	4,052.76	4,359.90	2,510.00	2,900.00			2,200.00		1,850.00	\$3,415.34
Iowa.....	44,432.16	7,006.00	1,971.16	9,309.66	3,100.00	8,346.92	3,600.53			1,411.50		800.37	1,116.15
Kansas.....	36,035.00	4,202.29		316.38	8,311.77	1,971.34	327.58	781.64	892.99	626.61		521.26	656.18
Kentucky.....	48,661.65	6,824.19	1,268.67	20,500.43	5,217.81	1,788.37	8,308.60						62.50
Louisiana.....	35,853.87	2,192.78	1,902.64	9,662.15	7,164.66	2,738.37							
Maine.....	18,045.18	4,405.20	421.23	9,514.52	3,100.52	1,38.38	2,929.37			1,750.21		1,399.02	
Maryland.....	24,202.34	3,976.73	832.69	6,455.84	3,506.66	478.69	1,607.15			1,000.80		1,183.37	
Massachusetts.....	15,373.04	2,700.00	767.78	3,286.46	2,684.46		2,774.00			3,216.80			
Michigan.....	43,059.35	4,499.66		20,640.00	3,828.50	4,153.02	5,124.94			1,800.00		1,979.54	
Minnesota.....	37,314.81	4,063.46	1,373.03	8,940.00	6,735.65		2,480.00			2,788.90		2,243.96	1,919.14
Mississippi.....	45,437.11	4,063.46	2,371.37	7,789.35	3,457.48	1,749.36	4,214.65			1,504.51			
Missouri.....	52,229.82	6,325.73	533.09	6,811.07	2,408.63		780.93			499.99		400.14	
Montana.....	15,405.35	2,447.95	791.11	8,688.51	3,150.75	2,814.77	1,966.82					1,047.00	1,063.36
Nebraska.....	29,645.80	5,494.42	76.80	1,658.51	1,207.37		2,968.04			1,387.62		2,003.61	
Nevada.....	11,527.00	2,201.61		5,923.78	2,689.91					1,736.00		1,166.64	
New Hampshire.....	13,911.34	1,118.24	1,034.49	4,513.73	2,921.04		3,043.19			4,572.15			498.91
New Jersey.....	24,041.91	4,773.04	797.95	7,000.00	2,421.55	1,856.75	2,945.81			1,650.00		1,872.21	
New Mexico.....	16,257.54	4,919.52	515.55	11,338.20	8,218.75	3,852.16	3,264.38					3,306.27	
New York.....	52,978.82	2,881.04	515.55	11,338.20	8,218.75	3,852.16	8,597.79			415.00		1,908.48	550.00
North Carolina.....	52,079.88	6,431.03	2,354.00	15,019.71	9,484.17		474.05					640.00	
North Dakota.....	21,453.18			15,019.71									
Ohio.....	12,854.72	2,687.23	2,687.23	19,003.06	12,967.03	2,801.22	1,110.00	902.85		1,000.00		6,950.00	
Oklahoma.....	56,853.66	5,853.66		6,263.99	1,700.73	4,172.73	1,913.56						
Oregon.....	39,802.10	2,823.00	981.19	23,123.73	1,852.39								
Pennsylvania.....	18,151.06	2,841.06		56,312.73									
Rhode Island.....	77,638.54	7,327.17		1,540.01			1,478.93			1,737.82			
Rhode Island.....	10,400.24	3,647.06	71.25	17,185.40	8,343.00		786.03			1,054.88		1,221.24	
South Carolina.....	38,767.11	3,016.69	830.70	17,631.80	8,343.00					2,202.81		1,661.27	2,644.05
South Dakota.....	21,355.90	5,834.25	18.24	2,291.60	1,446.25		1,981.81						

Tennessee.....	48,908.52	15,585.68	2,307.03	8,509.29	8,908.36	14,738.22	3,278.21	.....	2,081.01	1,408.00	1,910.51	.....
Texas.....	75,944.39	20,494.28	5,369.31	15,880.37	6,346.82	1,102.29	450.00	.....	2,622.46	.....	1,784.77	.....
Utah.....	14,467.35	3,584.40	171.72	8,320.68	1,102.29	.....	1,570.37	.....	.....	.....	.....	.....
Vermont.....	14,168.57	3,473.27	171.83	2,758.11	2,300.90	2,567.46	1,083.81	.....	.....	.....	640.24	.....
Virginia.....	45,381.93	8,970.60	.....	8,443.36	15,549.30	37.94	4,418.04	.....	1,208.16	.....	3,613.47	.....
Washington.....	21,957.84	3,536.39	.....	5,029.32	1,943.33	.....	4,918.44	.....	.....	402.14	81.05	.....
West Virginia.....	32,131.50	4,573.33	.....	12,067.15	4,013.89	900.00	1,799.15	.....	802.50	.....	1,200.00	.....
Wisconsin.....	39,635.81	5,233.29	1,421.30	5,693.16	5,780.00	3,151.41	2,058.31	.....	4,000.00	.....	1,171.56	.....
Wyoming.....	12,290.20	3,939.32	587.35	1,652.43	2,753.10	108.10	.....	.....	.....	.....	.....	.....
Total, 1917.....	1,580,000.00	249,738.80	43,881.48	453,417.17	201,229.14	60,425.12	105,290.22	3,622.87	55,335.62	21,577.05	49,536.76	11,807.83
1916.....	1,180,000.00	177,213.30	27,867.77	289,708.77	174,753.22	03,125.80	63,189.11	3,201.37	27,104.06	18,014.85	38,365.08	9,593.93
1915.....	480,000.00	86,278.39	8,241.16	128,083.33	69,890.05	33,821.65	32,944.29	326.82	8,314.02	5,373.76	16,269.72	3,930.67

South Dakota.....	199.38	1,534.91	416.63	1,635.03	2,006.64	1,756.37	.....	.....
Tennessee.....	5,298.52	383.75	.....	.....	.....	.....	.....	.....
Texas.....	.....	3,794.63	.....	.....	.....	.....	.....	.....
Utah.....	.....	.....	.....	150.00	614.45	3,601.15	.....	4.17
Vermont.....	.....	.....	.....	.....	968.90	.....	67.75	.....
Virginia.....	.....	4,247.07	.....	1,008.58	.....	.....	357.73	.....
Washington.....	1,685.94	.....	.....	.....	812.70	.....	.....	.....
West Virginia.....	2,168.33	1,946.81	.....	.....	.....	.....	.....	.....
Wisconsin.....	3,157.50	2,500.00	.....	2,550.00	.....	.....	.....	.....
Wyoming.....	.....	1,000.00	.....	.....	.....	.....	.....	.....
Total, 1917.....	56,668.96	45,773.14	11,691.68	21,730.76	32,786.96	10,510.03	18,374.98	4,945.63
1916.....	35,352.22	42,949.87	7,957.23	15,680.02	34,004.56	3,197.30	7,201.80	2,076.27
1915.....	9,191.99	16,309.53	440.00	1,180.15	4,369.31	126.00	2,298.60	5,065.27

Expenditures for cooperative agricultural extension for the year ended June 30, 1917, by projects—Continued.

EXPENDITURES FROM THE UNITED STATES APPROPRIATION OF MAY 8, 1914 (STATE SMITH-LEVER).

State.	Total.	Adminis- tration.	Printing and dis- tribution of publi- cations.	County agent.	Home eco- nomics.	Extension schools.	Boys' clubs.	Pig clubs.	Poultry clubs.	Animal hus- bandry.	Poultry.	Dairying.	Animal diseases.
Alabama.....	\$39,401.67			\$30,889.85	\$4,740.63	\$147.23	\$2,538.63	\$1,037.56	\$175.00	\$746.04			
Arizona.....	3,145.03	\$391.33	\$172.00	988.00	4,823.79		700.43			200.00			
Arkansas.....	30,577.08	6,263.71	1,506.95	13,854.67	669.51		1,789.98			533.60			
California.....	20,253.33	3,080.30	339.25	13,467.38	1,093.18		1,012.78						
Colorado.....	8,786.47	745.48	275.46	3,080.11	1,145.26		100.00			\$415.94		\$215.27	
Connecticut.....	2,501.53	1,000.32		1,145.26	376.10								
Delaware.....	2,345.76	244.20		1,410.19	40.00								
Florida.....	11,892.73	3,777.74	1,600.81	6,474.18									
Georgia.....	46,151.36		5,000.00	31,660.32									
Idaho.....	5,699.54	2,024.30		1,308.92	537.90		837.72			407.87		1,808.08	
Illinois.....	48,184.03			48,184.03									
Indiana.....	34,706.87			34,706.87									
Iowa.....	34,432.16	7,083.61	1,669.65	8,790.34	3,100.00	2,707.16	2,900.00				300.00	1,796.63	\$425.00
Kansas.....	26,685.00	9.43	5.60	22,626.48	12.54		1,514.36				52.30	12.67	534.57
Kentucky.....	38,661.65	2,378.79		8,946.33	7,831.84	900.00		100.00		2,500.00	800.00	1,000.00	1,800.00
Louisiana.....	25,833.87	1,183.65		12,527.67	3,812.80		4,768.51						
Maine.....	8,045.18	955.46		4,508.42							1,086.04	845.26	
Maryland.....	14,202.34	1,987.18	1,086.31	3,433.52	3,633.29		1,018.60			994.36			269.93
Massachusetts.....	5,373.04	348.41		2,410.00			2,614.63						
Michigan.....	33,039.35	817.22	1,529.21	13,641.87	2,270.47	2,386.06	4,352.51			1,093.97	649.72	2,274.47	
Minnesota.....	27,314.81	2,957.72	1,888.97	15,268.06	44.39		3,020.46			626.92			
Mississippi.....	35,437.14			23,843.38	6,005.52	2,775.62	2,900.00			624.53	328.81	459.19	1,815.86
Missouri.....	42,229.32	5,547.57	2,291.50	7,750.42		1,550.56	7,214.57						
Montana.....	5,408.35			5,408.35									
Nebraska.....	19,645.80	5,114.01	698.23	3,109.04	2,995.08	2,379.62	1,438.82					425.65	
Nevada.....	1,527.06	352.80	10.00				276.31					259.94	245.18
New Hampshire.....	3,911.34	841.23		35.44	275.71						950.00	241.08	
New Jersey.....	14,041.91			9,833.36	251.03		37.50						
New Mexico.....	6,257.54	150.00		5,439.74			317.89						
New York.....	42,978.32	555.56		23,600.00	750.00	3,638.79	750.00			811.15	411.66	4,430.67	
North Carolina.....	42,073.80	1,750.50	2,353.50	18,066.51	9,123.00		1,631.30			2,821.48			
North Dakota.....	11,433.18			5,780.16	2,976.21		374.05			415.60			
Ohio.....	46,833.66	6,791.89		12,517.32	14,629.99	1,927.43							
Oklahoma.....	29,892.10	8,169.16	1,390.00	12,378.01	4,736.08	576.88	540.00	21.47	1,130.00			1,900.00	
Oregon.....	8,151.66	2,644.65		1,800.45		585.50							
Pennsylvania.....	67,638.54	4,012.78	4,254.96	32,414.09	7,911.37	1,577.46	3,151.59			2,341.93	1,956.67		
Rhode Island.....	400.24	393.93			4.59						1.72		
South Carolina.....	28,707.11	1,335.49	704.46	11,642.71	8,238.20		644.15			848.90	700.00	803.15	

[illegible]

Expenditures for cooperative agricultural extension for the year ended June 30, 1917, by projects—Continued.

EXPENDITURES FROM THE UNITED STATES APPROPRIATION OF MAY 8, 1914 (STATE SMITH-LEVER)—Continued.

State.	Agronomy.	Horticulture.	Botany and plant pathology.	Entomology, apiculture, ornithology.	Forestry.	Agricultural engineering.	Farm management.	Rural organization.	Marketing.	Exhibits and fairs.	Miscellaneous specialists.	Balance.
Alabama.....												
Arizona.....												
Arkansas.....							\$649.78		\$200.00		\$4,667.96	
California.....							1,516.69		499.26		288.95	\$0.01
Colorado.....												
Connecticut.....												
Delaware.....												
Florida.....						\$2,000.00			1,272.96			
Georgia.....	\$2,400.00	\$1,950.00										
Idaho.....		582.83										
Illinois.....												
Indiana.....						1,750.00	275.00					
Iowa.....	3,572.27	62.50					1,628.24		4,434.17		165.76	4,930.50
Kansas.....	140.67	109.03		\$89.11					1,565.34			
Kentucky.....	1,500.00	750.00										
Louisiana.....												
Maine.....	700.09	891.34										
Maryland.....												
Massachusetts.....												
Michigan.....	1,335.30	2,515.38		383.13	\$378.97	413.11	1,272.25					
Minnesota.....		1,363.67	\$1,879.46				852.26					
Mississippi.....						1,000.00	333.33					
Missouri.....	1,475.00	881.38		455.71		473.65	391.43	\$3,581.35	\$1,382.27			
Montana.....												
Nebraska.....	750.00	1,779.52					895.83				382.83	
Nevada.....												
New Hampshire.....	1,200.00				47.91		1,049.97		900.00			8.92
New Jersey.....	700.00	1,120.00										
New Mexico.....							350.00					
New York.....	3,600.00	166.72	3,250.00	3,000.00	2,441.44							
North Carolina.....						1,882.90						
North Dakota.....							1,907.16					
Ohio.....	2,800.00					1,500.00	618.85				4,166.66	1.52
Oklahoma.....						839.90						.51
Oregon.....												
Pennsylvania.....	2,784.06	324.67		2,660.49			2,791.07			1,457.40	2,797.09	
Rhode Island.....												
South Carolina.....	1,061.34	1,320.15	550.00	280.23					618.27			

South Dakota.....																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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Expenditures for cooperative agricultural extension for the year ended June 30, 1917, by projects—Continued.

EXPENDITURES FROM THE UNITED STATES APPROPRIATION OF MAY 8, 1914 (FEDERAL AND STATE SMITH-LEVER).

State.	Total.	Adminis- tration.	Printing and dis- tribution of pub- lications.	County agent.	Home eco- nomics schools.	Extension schools.	Boys' clubs.	Pig clubs.	Poultry clubs.	Animal hins- bandry.	Poultry.	Dairying.	Animal diseases.
Alabama.....	\$88,804.34	\$5,017.05	\$2,613.16	\$42,634.90	\$18,323.43	\$1,909.74	\$3,088.63	\$1,717.74	\$1,894.12	\$1,103.08		\$1,423.75	
Arizona.....	16,290.06	6,656.59	810.40	2,464.50	355.65	555.83	1,921.70			3,178.75			
Arkansas.....	71,134.16	14,705.30	3,010.86	27,289.75	11,106.37			377.19		319.38			
California.....	50,470.66	8,651.97	1,318.70	31,130.34	4,396.71		4,084.23						
Colorado.....	27,572.94	6,864.68	981.45	9,309.96	2,434.72		2,649.34			2,607.65			
Connecticut.....	13,123.06	2,628.08		5,255.83			2,438.99				\$2,083.69	1,900.83	
Delaware.....	14,091.32	2,897.45	9.30	6,907.65	2,498.29		350.00				301.13	1,226.43	
Florida.....	33,786.46	5,015.13	1,648.34	11,875.23	11,701.80		3,641.96						
Georgia.....	102,302.72	18,162.03	5,000.00	32,575.33	24,197.81	3,215.48	1,934.71	901.01	1,020.62	3,377.27		1,808.08	
Idaho.....	21,399.08	5,581.11	230.65	6,902.75	1,348.40	833.69	1,609.88			1,093.59			
Illinois.....	106,368.06	3,097.76	2,606.23	75,928.22	11,428.47								
Indiana.....	79,413.74	4,263.90	734.09	38,759.63	4,359.90	1,899.84	5,514.19			4,358.16	3,259.83	2,636.43	
Iowa.....	78,894.32	14,083.61	3,640.81	18,100.00	6,200.00	5,517.16	5,800.00			2,500.00	2,500.00	3,646.63	\$3,840.34
Kansas.....	67,370.00	4,211.72	5.60	22,942.86	8,324.31	8,346.92	5,114.89			1,411.50	912.67	1,294.23	1,630.72
Kentucky.....	87,323.30	9,202.98	1,268.67	29,436.78	13,019.65	2,871.34	327.58	881.64	1,692.99	3,126.61	1,331.26	1,656.18	2,400.58
Louisiana.....	61,707.74	3,376.43	1,902.64	22,189.82	10,977.46	2,788.57	13,077.11		1,830.14				
Maine.....	26,040.36	5,360.66	421.23	14,072.94	3,190.52	138.38					1,686.01	907.76	
Maryland.....	38,494.68	5,963.91	1,919.00	9,889.36	7,199.95		3,917.97			2,714.57		1,486.74	269.95
Massachusetts.....	20,746.08	348.41	757.78	5,696.46	2,684.46	478.69	4,221.78			1,006.80	2,881.19	1,185.37	
Minnesota.....	76,118.70	3,517.22	1,529.21	34,241.87	6,098.97	2,396.06	7,126.51			4,910.77			
Mississippi.....	64,629.62	7,457.38	1,888.97	19,629.09	6,780.04	4,153.02	5,124.94				2,831.88	4,254.01	
Missouri.....	80,874.28	4,063.46	1,373.03	32,783.38	19,884.11	2,775.62	5,380.00			2,426.92	937.43		
Montana.....	94,453.64	11,873.30	4,662.87	15,539.77	9,463.00	3,299.92	11,439.23			3,413.43	525.71	2,703.15	3,735.30
Nebraska.....	20,816.70	3,447.95	553.09	12,219.42	2,508.63		780.83			999.99			
Nevada.....	49,291.60	10,608.43	1,489.34	11,858.93	6,145.83	5,194.39	3,425.64			1,904.51		825.79	
New Hampshire.....	13,054.12	2,554.41	86.80	1,688.51	1,207.37		3,245.35					1,306.94	1,308.54
New Jersey.....	17,822.68	1,959.47		5,959.22	2,375.62						2,337.62	2,464.69	
New Mexico.....	38,083.82	4,773.04	1,034.49	14,347.09	3,175.09	1,836.75	3,080.69					2,113.29	
New York.....	22,515.08	5,069.52	797.95	6,139.74	2,421.55		3,263.61					1,166.64	
North Carolina.....	95,936.64	3,436.60	515.55	34,938.26	8,968.17	7,490.95	4,014.88			5,883.30	2,147.60	7,736.94	498.91
North Dakota.....	44,159.72	8,181.53	4,707.30	23,289.95	18,607.17		9,619.09			4,471.48			
Ohio.....	32,906.36			20,739.87	6,467.88		848.10						
Oklahoma.....	103,707.32	19,646.61	2,687.23	31,517.72	27,597.02	4,728.65							
Oregon.....	69,604.20	10,992.16	2,636.67	35,501.74	10,910.07	2,272.61	1,650.00	994.32	1,130.00			640.00	530.00
Pennsylvania.....	23,303.32	5,485.71	1,305.16	3,652.84	3,652.84		1,913.56						
Rhode Island.....	145,277.08	11,339.95	6,531.24	85,726.82	7,911.37	1,577.46	3,151.59			3,341.93	1,496.67	6,950.00	
Rhode Island.....	10,800.45	4,010.99	71.25	631.49	1,544.60		1,478.93				1,739.54		
South Carolina.....	67,534.22	4,352.18	1,544.25	28,828.51	16,601.20		1,430.18			2,209.49	1,754.88	2,029.42	

South Dakota.....	32,911.92	8,826.16	18.24	2,291.65	1,446.29	6,314.05	1,981.81	.....	2,292.81	.....	1,004.27	2,644.05
Tennessee.....	87,737.04	17,781.31	4,291.74	17,708.83	21,914.01	7,691.53	.....	.....	.....	.....	2,485.19	.....
Texas.....	141,888.78	22,882.18	6,680.01	38,133.01	11,248.83	14,946.55	4,808.37	.....	2,681.01	1,468.00	3,400.59	.....
Utah.....	18,934.70	4,009.67	339.82	8,742.45	2,332.17	.....	881.34	.....	10,369.56	.....	495.58	139.73
Vermont.....	18,337.14	4,446.26	382.52	5,520.03	2,404.33	2,567.46	1,680.91	.....	.....	.....	.....	.....
Virginia.....	89,663.86	10,894.96	1,642.27	33,690.79	17,892.76	3,309.50	1,157.70	1,298.16	4,410.06	.....	1,498.81	.....
Washington.....	33,915.68	5,459.85	1,025.11	7,793.84	3,553.31	.....	6,530.47	.....	.....	935.92	5,117.08	.....
West Virginia.....	51,263.00	9,303.52	.....	19,672.55	8,154.08	1,254.16	8,017.12	.....	2,071.11	.....	81.05	.....
Wisconsin.....	69,271.62	7,982.41	1,421.30	23,693.97	6,245.00	3,651.41	1,799.15	.....	5,170.88	.....	2,350.00	.....
Wyoming.....	14,580.40	6,249.52	587.35	1,652.43	2,753.10	108.10	2,058.34	.....	.....	.....	1,171.56	.....
Total 1917.....	2,680,000.00	347,041.33	78,700.98	994,912.22	387,464.92	105,927.06	155,499.90	4,801.90	81,415.81	30,304.69	73,843.04	17,038.10
1916.....	1,680,000.00	267,258.89	43,056.11	572,786.19	243,221.66	88,880.45	91,662.65	3,201.37	34,409.53	24,720.94	48,270.51	12,000.81

Expenditures for cooperative agricultural extension for the year ended June 30, 1917, by projects—Continued.

EXPENDITURES FROM THE UNITED STATES APPROPRIATION OF MAY 8, 1914 (FEDERAL AND STATE SMITH-LEVER).--Continued.

[illegible]

South Carolina.....	2, 210.98	3, 121.74	1, 308.36	589.74	.....	1 635.03	2, 006.64	.....	1, 523.38	.....	.....
South Dakota.....	139.38	1, 534.91	.....	416.63	.....	.....	.....	.....	.....	.....	.....
Tennessee.....	5, 298.52	1, 292.50	102.21	211.50	.....	.....	.....	12, 656.30	1, 810.39	.....	.....
Texas.....	.....	.....	16, 626.01	.....	.....	241.34	614.45	.....	.....	1, 138.15	8.34
Utah.....	.....	.....	.....	.....	.....	.....	988.90	.....	.....	337.73	.....
Vermont.....	.....	.....	.....	.....	.....	1, 008.58	1, 239.32	.....	.....	.....	.....
Virginia.....	.....	6, 800.27	.....	.....	.....	.....	.....	.....	.....	.....	.....
Washington.....	2, 427.78	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
West Virginia.....	3, 014.76	2, 661.65	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wisconsin.....	3, 757.50	2, 500.00	2, 350.00	.....	1, 300.00	4, 800.00	650.00	.....	.....	.....	.....
Total, 1917.....	83 102.63	63 956.57	30 334.73	14, 987.30	7, 762.90	34, 151.75	48, 425.33	23, 146.53	27, 919.00	5, 293.07	9, 891.26
1916.....	41, 732.07	52, 861.57	12, 190.35	8, 164.38	1, 857.34	18, 685.57	40, 069.60	15, 476.68	9, 654.99	4, 183.38	4, 132.34

Sources of offset to Federal Smith-Lever funds for the year ending June 30, 1917.

State.	Total.	State.	County.	College.	Other.	Balance.
Alabama.....	\$39,401.67	\$21,895.33	\$11,994.52	\$5,511.82		
Arizona.....	3,145.03	3,145.03				
Arkansas.....	30,577.08	26,343.76	4,233.32			
California.....	20,235.33	20,235.33				
Colorado.....	8,786.47	8,786.47				
Connecticut.....	2,561.53	2,561.53				
Delaware.....	2,345.76	2,345.76				
Florida.....	11,892.73	11,892.73				
Georgia.....	46,151.36	46,151.36				
Idaho.....	5,699.54	5,699.54				
Illinois.....	48,184.03				48,184.03	
Indiana.....	34,706.87	34,706.87				
Iowa.....	34,432.16	34,432.16				
Kansas.....	26,685.00	26,685.00				
Kentucky.....	38,661.65	29,364.88	4,166.97		199.30	4,930.50
Louisiana.....	25,853.87	20,000.00	5,853.87			
Maine.....	8,045.18	8,045.18				
Maryland.....	14,202.34	14,202.34				
Massachusetts.....	5,373.04	5,373.04				
Michigan.....	33,059.35		10,118.71	22,940.64		
Minnesota.....	27,314.81	27,314.81				
Mississippi.....	35,437.14	13,000.00	22,437.14			
Missouri.....	42,229.32	38,037.59	4,191.73			
Montana.....	5,408.35	5,408.35				
Nebraska.....	19,645.80	19,645.80				
Nevada.....	1,527.06	1,527.06				
New Hampshire.....	3,911.34	3,911.34				
New Jersey.....	14,041.91	14,032.99				8.92
New Mexico.....	6,257.54	6,257.54				
New York.....	42,978.32	42,978.32				
North Carolina.....	42,079.86	11,477.00		30,602.86		
North Dakota.....	11,453.18	11,453.18				
Ohio.....	46,853.66	46,852.14				1.52
Oklahoma.....	29,802.10	29,801.59				.51
Oregon.....	8,151.66	8,151.66				
Pennsylvania.....	67,638.54	37,578.06	30,060.48			
Rhode Island.....	400.24	400.24				
South Carolina.....	28,767.11	28,767.11				
South Dakota.....	11,305.96	11,305.96				
Tennessee.....	38,868.52	38,868.52				
Texas.....	65,944.39	65,940.22				4.17
Utah.....	4,467.35	4,467.35				
Vermont.....	4,168.57	4,168.57				
Virginia.....	35,331.93	33,831.93	1,500.00			
Washington.....	11,957.84	11,957.84				
West Virginia.....	22,131.50	22,131.50				
Wisconsin.....	29,635.81	29,635.81				
Wyoming.....	2,290.20	2,290.20				
Total, 1917.....	1,100,000.09	893,058.99	94,559.74	59,055.32	48,383.33	4,045.62
1916.....	600,000.00	470,649.42	69,226.79	26,834.76	31,212.76	2,076.27

Total expenditures of funds from all sources for cooperative agricultural extension for the year ended June 30, 1917.

BY SOURCES OF FUNDS.

State.	Total.	United States Department of Agriculture.			Smith-Lever.		State.	County.	College.	Other.
		States Relations Service.	Other bureaus and offices.	Federal.	State.					
Alabama.....	\$175,336.25	\$45,493.92	\$10,834.11	\$49,401.67	\$39,401.67	\$1,886.17	\$25,012.40			\$5,192.48
Arizona.....	29,504.34	3,268.82	1,000.00	13,145.03	3,145.03		3,640.40			1,418.89
Arkansas.....	197,537.14	39,835.92	8,764.33	40,577.08	30,577.08		71,133.45			6,663.28
California.....	110,312.76	11,564.92	5,136.74	50,235.33	20,235.33		26,000.00	\$17,140.44		
Colorado.....	50,660.68	12,746.51	500.00	13,786.47	8,786.47					159.40
Connecticut.....	73,065.51	8,873.74	1,615.84	12,561.53	2,561.53		37,812.23			
Delaware.....	16,596.56	821.66	1,083.38	12,345.76	2,345.76					
Florida.....	114,501.74	23,328.70	3,329.92	21,892.73	11,892.73		38,153.84			3,417.71
Georgia.....	200,841.99	53,502.49	12,640.63	56,151.36	46,151.36		85,770.00			1,366.00
Idaho.....	42,593.94	7,131.10	2,626.60	15,699.54	5,699.54					
Illinois.....	171,098.12	12,833.23		58,184.03	48,184.03					
Indiana.....	222,714.34	16,990.18	2,859.64	44,706.87	34,706.87		26,033.36			24,089.47
Iowa.....	174,427.09	13,557.35	3,263.04	44,432.16	34,432.16		55,620.08			23,272.40
Kansas.....	154,105.70	15,831.27		36,685.00	26,685.00					1,000.25
Kentucky.....	157,922.76	34,005.71	3,308.63	43,731.15	33,731.15		17,065.67			5,237.50
Louisiana.....	143,020.64	37,809.93	6,621.23	35,853.87	25,853.87		33,000.00			7,000.00
Maine.....	32,957.35	4,843.33		33,843.18	3,843.18		35,621.74			800.00
Maryland.....	80,657.79	19,096.63	2,861.48	24,202.34	14,202.34					
Massachusetts.....	147,043.07	15,012.96	2,688.54	15,373.04	5,373.04		55,846.00			
Michigan.....	120,543.04	22,712.66	765.00	43,059.35	33,059.35		5,866.47			
Minnesota.....	139,325.56	15,025.47	2,937.85	37,314.81	27,314.81		13,859.78			6,591.22
Mississippi.....	106,534.98	43,638.80	8,085.89	45,437.14	35,437.14		15,813.95			6,184.77
Missouri.....	123,844.10	9,626.16		52,229.32	42,229.32		10,056.02			
Montana.....	80,752.99	10,643.01	4,868.28	15,408.35	5,408.35					
Nebraska.....	158,616.57	14,368.91	3,511.97	29,645.80	19,645.80		15,000.00			61,330.00
Nevada.....	26,493.06	2,027.03		11,927.06	1,927.06		7,990.07			
New Hampshire.....	54,549.72	8,943.34	3,700.00	13,911.34	3,911.34		9,800.00			16,004.74
New Mexico.....	77,632.75	8,998.72		24,032.99	14,032.99		9,300.00			600.00
New York.....	58,896.66	10,510.69	2,150.00	16,237.54	6,237.54		19,173.38			404.51
North Carolina.....	298,851.74	25,893.87	334.85	52,978.32	42,978.32		14,709.04			
North Dakota.....	282,467.81	43,164.37	11,573.72	52,079.86	42,079.86		124,428.61			
Ohio.....	95,937.91	9,724.53	3,733.86	21,453.13	11,453.13		38,570.00			1,000.25
Oklahoma.....	200,611.91	33,214.47	1,500.00	56,832.14	46,832.14		26,957.72			18,333.19
Oregon.....	170,534.65	39,173.47	6,837.59	39,801.39	29,801.39		22,406.74			1,224.66
	123,830.85	10,328.43	9,024.38	13,151.66	8,151.66		54,543.32			

Total expenditures of funds from all sources for cooperative agricultural extension for the year ended June 30, 1917—Continued.

BY SOURCES OF FUNDS—Continued.

State.	Total.	United States Department of Agriculture.		Smith-Lever.		State.	County.	College.	Other.
		States Relations Service.	Other bureaus and offices.	Federal.	State.				
Pennsylvania.....	\$158,439.91	\$10,479.00	\$2,683.83	\$77,638.54	\$67,638.54	.....	.....	.....	.....
Rhode Island.....	15,428.08	4,000.03	.....	10,400.24	400.24	.....	.....	\$627.57	.....
South Carolina.....	178,437.20	44,478.56	15,651.70	38,767.11	28,767.11	.....	.....	6,447.57	\$7,881.90
South Dakota.....	75,157.64	7,800.60	1,550.00	21,305.96	11,305.96	.....	.....	.....	.....
Tennessee.....	198,008.71	37,610.71	15,012.00	48,868.52	38,868.52	.....	.....	.....	8,797.51
Texas.....	306,137.50	66,686.63	7,315.76	75,940.22	65,940.22	.....	.....	.....	.....
Utah.....	63,836.40	10,617.37	2,725.00	14,467.35	4,467.35	.....	8,790.00	.....	.....
Vermont.....	38,084.55	12,467.56	3,013.74	14,168.57	4,168.57	.....	.....	.....	.....
Virginia.....	164,983.52	37,031.01	2,396.84	45,331.93	35,331.93	.....	.....	.....	.....
Washington.....	109,300.01	11,890.42	2,233.92	21,957.84	11,957.84	.....	.....	.....	9,122.00
West Virginia.....	133,230.03	23,475.88	1,133.33	32,131.50	22,131.50	.....	.....	1,282.46	16,790.00
Wisconsin.....	114,904.91	11,118.33	1,283.33	39,635.81	29,635.81	.....	.....	.....	10,355.25
Wyoming.....	56,758.89	8,530.21	2,250.00	12,230.20	2,230.20	.....	.....	13,699.47	.....
Total, 1917.....	6,149,619.63	958,333.87	185,893.15	1,575,054.38	1,095,054.38	.....	.....	.....	.....
1916.....	4,864,180.94	900,389.92	165,172.01	1,077,923.73	597,923.73	.....	.....	196,839.01	244,873.55
1915.....	3,597,235.85	905,782.00	105,168.40	474,934.73	.....	.....	.....	220,934.32	276,786.00
								319,825.25	286,745.50

Total expenditures of funds from all sources for cooperative agricultural extension for the year ended June 30, 1917—Continued.

BY ITEMS OF EXPENSE.

State.	Amount of appropriation.	Salaries.	Labor.	Publications.	Stationery and small printing.	Postage, telegraph, telephone, freight, and express.	Heat, light, water, and power.	Supplies.	Library.	Tools, machinery, and appliances.	Furniture and fixtures.	Scientific apparatus and specimens.	Live stock.	Traveling expenses.	Contingent expenses.
Alabama.....	\$175,336.25	\$147,110.06	\$2,195.25	\$2,613.16	\$1,882.38	\$1,049.55	\$169.43	\$666.40	\$66.45	\$134.34	\$623.66	\$126.22	.....	\$17,288.76	\$1,410.59
Arizona.....	197,594.34	16,866.88	116.90	1,082.95	794.25	293.16	.....	412.46	.....	28.90	991.39	197.18	.....	8,215.72	499.55
Arkansas.....	171,941.79	53,740.80	482.06	3,010.80	2,035.22	230.38	162.00	273.18	17.00	26.00	1,676.52	.....	.....	16,389.70	711.68
California.....	110,312.76	53,740.80	4,872.39	1,818.70	1,777.48	740.20	.....	1,162.23	10.42	151.22	808.93	26.75	.....	35,287.80	10,416.32
Colorado.....	50,660.68	32,833.96	4,404.13	1,324.20	863.90	978.58	6.95	1,162.23	22.00	236.16	990.97	40.05	.....	10,708.62	213.25
Connecticut.....	75,065.51	46,065.51	1,068.56	3,148.48	4,411.62	1,301.51	686.28	2,558.09	10.07	624.97	742.64	124.71	\$1,148.50	13,497.93	2,356.39
Delaware.....	16,596.56	12,071.21	80.15	9.50	422.92	208.08	9.72	246.55	.....	45.09	212.39	11.20	.....	3,239.25	19.50
Florida.....	114,501.74	98,523.51	129.50	1,618.34	631.98	115.33	.....	102.27	.....	279.61	480.87	.....	.....	11,374.99	1,474.92
Georgia.....	260,841.99	214,394.58	1,445.05	5,651.30	1,340.32	1,475.30	737.91	3,116.06	15.95	478.28	1,405.12	309.80	48.00	29,879.61	733.38
Idaho.....	42,593.94	24,515.48	2,003.37	3,066.65	1,511.55	975.27	1.80	1,179.33	22.65	478.28	856.38	313.44	.....	9,638.73	1,791.01
Illinois.....	171,698.12	127,695.09	5,067.34	2,636.23	1,279.73	445.75	5.25	382.25	64.24	1,049.12	469.20	64.25	.....	19,096.64	17,943.03
Indiana.....	222,714.34	148,479.40	1,504.36	1,757.11	8,085.21	1,530.58	5.65	21,844.90	.....	136.02	438.19	134.05	.....	41,980.46	98.41
Iowa.....	174,427.09	124,500.72	6,092.27	15,316.76	3,087.96	2,879.03	700.00	6,947.10	20.45	78.67	834.21	527.62	372.50	12,292.62	188.63
Kansas.....	154,105.70	111,243.52	356.94	87.51	1,563.52	3,040.48	.....	4,445.11	89.35	23.00	810.28	709.80	150.35	30,927.92	726.73
Kentucky.....	157,922.76	133,748.02	636.61	1,268.67	1,563.52	803.45	.....	4,445.11	89.35	55.10	520.30	7.20	.....	18,504.51	1,082.49
Louisiana.....	143,020.64	118,070.33	25.35	1,902.21	61.50	550.90	.....	2,016.71	3.00	.....	160.00	.....	.....	20,217.95	10.26
Maine.....	32,957.55	18,776.80	605.63	421.13	2,21.89	449.48	9.60	2,016.71	113.85	346.85	791.98	315.16	.....	8,493.00	2.85
Maryland.....	80,657.79	64,608.05	102.07	2,819.00	985.37	449.48	19.00	1,048.59	102.51	933.23	1,658.30	173.15	.....	7,220.41	537.21
Massachusetts.....	147,043.07	90,556.12	2,178.87	3,694.61	2,735.77	2,942.72	11.44	1,979.21	85.78	126.85	658.49	37.01	.....	22,975.03	19,198.17
Michigan.....	120,943.04	90,696.27	4,392.05	1,529.49	2,435.00	988.64	.....	477.11	.....	137.06	637.54	229.46	.....	18,936.70	65.75
Minnesota.....	139,325.56	89,360.34	8,888.80	10,294.77	2,418.45	2,040.50	22.62	821.22	11.25	998.93	620.57	262.33	.....	22,734.67	831.11
Mississippi.....	166,534.98	130,417.64	1,778.72	3,228.23	1,900.42	1,372.77	113.15	642.89	1.00	132.65	2,611.70	3.00	.....	23,735.36	574.85
Missouri.....	123,844.10	80,131.69	4,104.56	4,662.87	4,780.35	2,521.15	.....	2,589.81	303.56	251.80	2,811.47	474.39	12.24	31,137.70	12.50
Montana.....	80,752.99	37,428.53	.....	553.69	.....	2.42	.....	9,689.12	.....	.....	.....	.....	.....	31,940.05	1,139.78
Nebraska.....	158,616.57	72,949.08	1,378.27	1,526.37	14,081.85	1,465.17	3,000.00	9,836.40	153.00	1,969.54	1,862.25	39.86	.....	38,076.38	12,277.90
Nevada.....	26,493.06	15,523.60	237.95	938.24	791.80	391.62	.....	575.35	15.75	542.46	591.65	523.61	.....	5,110.78	1,250.25
New Hampshire.....	54,549.72	33,177.52	1,446.90	1,433.14	1,003.40	1,216.37	.....	619.21	7.18	45.63	922.74	.....	18.00	12,689.66	1,387.97
New Jersey.....	77,632.75	49,433.88	808.65	1,397.49	3,175.75	2,876.07	.....	1,600.12	9.32	618.99	1,283.70	258.29	.....	15,100.14	972.15
New Mexico.....	57,836.66	34,588.96	723.25	1,397.49	2,193.48	1,000.79	2.50	1,024.27	153.86	61.78	1,949.07	364.66	.....	15,716.68	502.75
New York.....	298,831.74	196,591.49	9,982.73	9,384.89	8,312.32	7,843.18	9.15	14,028.35	22.50	164.95	4,465.55	1,336.37	.....	50,607.80	2,109.11
North Carolina.....	282,467.61	225,521.67	1,193.54	8,707.80	2,610.40	1,919.55	12.16	1,424.42	140.99	321.40	4,566.55	473.80	.....	37,017.67	1,558.10
North Dakota.....	95,467.91	64,071.51	1,894.42	4,223.85	.....	528.10	.....	792.95	12.60	732.66	310.88	.....	.....	22,280.94	2,100.00
Ohio.....	200,611.91	124,093.22	4,434.09	7,788.17	9,541.23	3,380.79	.....	3,748.89	32.18	2,218.82	3,161.80	1,490.03	.....	40,908.91	371.78
Oklahoma.....	170,354.66	128,312.01	911.73	2,702.69	1,992.06	304.94	.....	3,702.81	20.10	28.50	1,276.53	4.70	.....	23,729.68	559.45
Oregon.....	123,830.85	77,528.39	3,711.25	2,412.39	2,319.28	3,051.17	72.87	1,945.96	.....	3,480.01	1,149.33	106.17	.....	23,021.41	4,279.42

Total expenditures of funds from all sources for cooperative agricultural extension for the year ended June 30, 1917—Continued.

BY ITEMS OF EXPENSE—Continued.

State.	Amount of appropriation.	Salaries.	Labor.	Publications.	Stationery and small printing.	Postage, telegraph, telephone, freight, and express.	Heat, light, water, and power.	Supplies.	Library.	Tools, machinery, and appliances.	Furniture and fixtures.	Scientific apparatus and specimens.	Live stock.	Traveling expenses.	Contingent expenses.
Pennsylvania.....	\$158,439.91	\$99,377.70	\$1,630.13	\$6,531.24	\$4,895.51	\$4,773.36	\$72.69	\$2,152.78	\$37.03	\$745.02	\$3,178.36	\$762.21	.....	\$32,840.88	\$1,443.00
Rhode Island.....	15,428.08	12,159.94	44.17	71.25	475.08	230.18	.....	109.31	50.55	27.79	10.60	13.99	.....	2,189.02	45.60
South Carolina.....	178,447.20	146,093.10	385.99	3,327.83	381.13	567.39	5.10	259.07	22.30	.....	667.51	.....	.....	25,749.38	988.40
South Dakota.....	75,157.64	50,335.18	4,453.45	18.24	1,481.54	1,299.59	73.33	870.71	40.12	287.61	1,018.22	229.84	.....	14,492.16	557.55
Tennessee.....	198,008.71	155,319.40	1,606.92	4,291.74	3,900.44	1,323.20	169.29	747.63	129.43	242.90	2,067.70	59.66	.....	26,781.03	1,369.37
Texas.....	306,137.50	245,342.25	67.73	6,689.01	2,697.80	1,983.83	.....	782.74	126.15	.....	1,204.12	93.72	.....	47,147.75	22.40
Utah.....	63,856.40	38,920.62	2,005.70	1,003.54	949.16	938.08	55.32	974.57	36.76	.....	767.10	.....	.....	17,417.45	788.40
Vermont.....	38,084.55	29,042.69	1,257.77	416.04	1,148.29	526.56	3.50	516.22	18.28	115.91	275.00	4.70	.....	4,742.17	17.47
Virginia.....	164,983.52	135,239.55	1,161.97	1,642.27	1,002.54	769.62	74.27	442.49	161.23	99.78	2,178.05	121.33	.....	20,999.15	2,091.27
Washington.....	104,300.01	63,649.17	3,133.81	1,643.36	2,542.69	1,139.30	.....	6,700.45	75.12	757.25	902.08	3.75	.....	28,460.78	292.25
West Virginia.....	133,230.03	99,421.21	3,714.88	1,886.62	3,715.94	1,172.92	.....	1,170.10	8.50	230.86	523.66	38.25	\$77.00	23,670.62	600.00
Wisconsin.....	114,904.91	80,340.71	3,340.59	1,749.38	825.19	1,000.99	.65	3,435.71	21.10	100.06	143.59	238.03	.....	23,918.96	49.95
Wyoming.....	56,758.89	34,907.25	725.53	2,045.38	1,877.22	664.20	.25	412.56	.....	91.85	403.25	325.61	.....	14,962.07	343.44
Total, 1917.....	6,149,619.63	4,406,021.73	84,878.32	144,777.26	113,947.63	68,330.02	6,214.88	116,804.55	2,256.33	19,178.19	53,394.57	10,567.50	1,826.08	1,023,405.63	98,016.34
1916.....	4,864,180.94	3,434,032.25	80,029.60	98,850.56	79,064.79	48,709.30	4,842.21	97,728.37	2,164.36	757.25	32,974.37	10,719.60	692.89	849,259.37	76,481.51
1915.....	3,597,235.85	2,616,999.86	69,954.09	72,090.72	49,640.47	37,437.90	9,614.79	55,886.15	707.48	17,094.67	36,155.66	6,870.21	2,255.99	603,432.74	19,125.12

BY PROJECTS.

State.	Total.	Admin- istration.	Printing and dis- tribution of pub- lications.	County agent.	Home econom- ics.	Exten- sion schools.	Boys' clubs.	Pig clubs.	Poultry clubs.	Animal hus- bandry.	Poultry. Dairying.	Animal diseases.	Preda- tory animals.
Alabama.....	\$175,336.25	\$5,617.05	\$2,613.16	\$103,406.82	\$30,934.02	\$1,909.74	\$5,344.92	\$1,717.74	\$1,894.12	\$4,482.30	\$0,243.86	\$2,634.78	
Arizona.....	29,504.34	7,110.13	9,782.27	1,032.95	1,135.65	1,300.13	3,723.64			3,255.00			\$1,000.00
Arkansas.....	197,557.14	14,705.50	3,010.86	116,127.94	38,262.12		1,645.11	377.19		4,446.14	1,601.38	2,436.19	
California.....	100,312.76	20,492.93	1,318.70	66,129.06	5,020.81		7,649.56			1,401.61		3,035.13	700.00
Colorado.....	50,660.68	6,893.43	1,824.20	26,550.88	2,584.72		4,989.10			2,607.65			200.00
Connecticut.....	75,065.51	5,268.82	1,518.59	46,648.60	1,123.04		5,400.20	290.34			3,713.31		
Delaware.....	16,596.56	2,997.46	9.50	7,789.31	2,408.29		350.00				2,319.81	3,329.92	
Florida.....	114,501.74	5,018.13	1,648.34	61,766.79	40,051.90		2,686.66						
Georgia.....	206,841.99	18,888.70	5,661.30	146,281.78	53,472.04	3,250.80	2,612.42	901.01	1,020.62	9,685.65	6,177.33		
Idaho.....	42,593.94	8,973.12	2,306.65	12,451.57	2,666.56	1,477.36	4,328.21			2,343.59	1,065.78		1,620.82
Illinois.....	171,698.12	3,097.76	2,636.23	135,690.07	11,428.47		12,506.11			7,757.91	3,610.28	7,585.25	
Indiana.....	222,714.34	18,724.01	1,757.11	100,018.28	4,612.24	7,921.80	12,184.71			6,320.59	3,633.51	10,994.03	4,350.90
Iowa.....	174,427.09	35,204.38	15,316.76	35,133.06	16,872.25	6,018.90	12,184.71			1,546.37	1,536.09	2,404.05	155.00
Kansas.....	154,105.70	7,690.54	87.51	57,700.12	12,497.80	9,233.28	8,775.09			1,692.99	2,262.61	1,656.18	
Kentucky.....	157,922.76	11,749.10	1,208.67	97,564.77	19,160.65	2,871.34	694.30	881.04		1,830.14	4,197.32		
Louisiana.....	143,020.64	3,376.43	1,902.64	86,094.78	21,074.64	2,788.57	13,766.64			1,923.64	2,120.51	907.76	
Maine.....	32,937.50	6,059.61	421.13	18,765.62	3,160.32	138.38	4,507.54			2,744.57		1,542.01	
Maryland.....	80,657.79	6,813.91	2,819.00	42,508.11	11,338.26		8,416.16			4,547.85	2,083.25		
Massachusetts.....	147,043.07	9,683.59	3,706.41	74,716.77	5,735.24	478.69	10,186.46			4,990.40	405.00		
Michigan.....	120,543.04	3,525.68	2,156.59	57,649.77	6,671.16	2,306.96	8,808.55				3,040.93		
Minnesota.....	139,325.56	27,318.95	48.04	52,495.37	7,371.99	4,991.62	11,245.24			4,445.79	525.71	3,735.30	
Mississippi.....	165,534.98	4,216.77	3,228.27	71,154.70	48,356.91	3,174.70	11,459.23			3,413.43			
Missouri.....	123,844.10	11,873.30	4,662.87	41,088.43	9,463.00	3,299.92	4,020.49			2,690.99			1,300.00
Montana.....	80,732.99	6,701.95	553.09	44,201.53	5,908.63		28,002.18			4,306.48			
Nebraska.....	158,016.57	13,965.77	1,526.87	46,348.25	9,023.13	32,887.62	5,300.00				300.00	3,050.83	2,200.00
Nevada.....	20,493.06	4,076.67	938.24	3,980.79	1,631.31		3,372.96				2,702.68		
New Hampshire.....	51,540.72	2,933.97	1,433.14	27,782.99	3,825.62		5,500.00						
New Jersey.....	77,632.75	8,699.83	1,397.49	41,934.33	4,088.93		5,428.44						750.00
New Mexico.....	58,836.06	6,640.77	1,547.96	33,637.34	2,766.41	1,903.35	5,601.75			7,361.36	5,782.57		
New York.....	288,851.74	16,545.47	9,384.89	180,830.36	13,017.80	15,909.00	7,197.04			19,700.65	2,380.23		
North Carolina.....	282,467.81	12,231.53	8,707.50	113,492.21	67,530.26		11,628.11			16,343.85	1,577.64	1,995.91	
North Dakota.....	95,937.91	10,091.05	5,484.80	57,188.97	7,166.73		4,474.40			2,784.10			3,509.86
Ohio.....	200,611.91	26,048.15	7,788.17	106,517.94	18,594.19	9,950.99	14,500.40			1,935.51	1,658.23	550.00	
Oklahoma.....	170,534.66	11,043.44	2,702.69	100,650.60	27,085.63		5,033.49	924.32	1,130.00	3,403.85			
Oregon.....	123,830.85	7,806.42	5,501.69	50,552.06	3,652.84	6,988.09	7,747.92			3,341.93			2,650.00
Pennsylvania.....	185,436.91	11,339.95	6,531.24	99,205.82	7,911.37		3,415.24			1,956.67	9,633.83		
Rhode Island.....	15,428.08	4,500.75	6.25	7,771.85	1,545.20		3,039.47			6,615.75	3,205.02		
South Carolina.....	178,447.20	8,423.64	3,327.83	79,401.14	52,418.90		3,682.67			2,292.81	2,354.27	2,644.05	200.00
South Dakota.....	75,157.64	8,826.16	18.24	33,436.38	1,446.29	12,926.68							

Total expenditures of funds from all sources for cooperative agricultural extension for the year ended June 30, 1917—Continued.

BY PROJECTS—Continued.

State.	Total.	Admin- istration.	Printing and dis- tribution of pub- lications.	County agent.	Home econom- ics.	Exten- sion schools.	Boys' clubs.	Pig clubs.	Poultry clubs.	Animal hus- bandry.	Poultry.	Dairying.	Animal diseases.	Preda- tory animals.
Tennessee.....	\$198,008.71	\$18,128.30	\$4,291.74	\$84,682.65	\$52,151.34	\$7,691.53	.....	.....	.....	\$5,981.01	\$3,038.38	\$8,522.62	\$3,104.69	.....
Texas.....	306,137.50	22,882.18	6,689.01	175,714.35	29,579.77	14,946.55	\$5,837.42	.....	.....	12,338.31	.....	8,837.60	.....	.....
Utah.....	63,856.40	9,279.39	1,003.54	27,164.04	5,743.60	3,902.12	6,131.17	.....	.....	.....	.....	2,844.41	391.29	\$1,200.00
Vermont.....	38,084.55	6,040.94	416.04	15,798.64	3,047.75	3,139.97	3,861.12	.....	.....	.....	.....	3,013.74	.....	.....
Virginia.....	164,983.52	13,302.51	1,642.27	92,307.24	37,344.18	3,417.95	2,093.47	.....	\$1,298.16	4,551.64	1,409.34	2,532.74	.....	.....
Washington.....	109,300.01	6,758.05	1,643.36	53,572.59	3,997.34	380.09	11,173.27	.....	.....	.....	1,077.17	25,091.66	.....	200.00
West Virginia.....	133,230.03	12,804.19	2,248.62	66,885.27	14,927.66	2,193.78	14,568.89	.....	.....	4,077.28	.....	2,436.61	.....	.....
Wisconsin.....	114,904.91	9,633.58	1,749.38	37,033.17	8,323.73	6,039.65	3,541.50	.....	.....	5,367.92	.....	4,061.35	.....	.....
Wyoming.....	56,758.89	7,855.00	2,045.38	32,885.36	2,822.00	108.10	6,024.16	.....	.....	.....	.....	3,074.24	.....	750.00
Total, 1917.....	6,149,619.63	512,891.54	137,647.87	3,058,040.94	741,679.89	175,754.15	319,556.91	\$0,248.37	9,612.88	155,815.37	49,885.66	208,946.50	44,216.83	16,435.08
1916.....	4,804,180.94	445,243.67	99,779.68	2,411,539.81	519,866.99	198,045.02	231,227.16	25,202.85	12,772.35	106,735.05	34,536.14	172,557.69	21,936.02	.....
1915.....	3,498,815.35	295,308.48	71,597.65	1,902,230.51	319,822.50	198,333.91	162,448.27	10,477.90	10,005.21	31,970.18	9,469.93	105,098.08	4,563.64	.....

Total expenditures of funds from all sources for cooperative agricultural extension for the year ended June 30, 1917—Continued.

BY PROJECTS—Continued.

State.	Agronomy.	Horticulture.	Botany and plant pathology.	Entomology, apiculture, ornithology.	Forestry.	Agricultural engineering.	Farm management.	Rural organization.	Marketing.	Exhibits and fairs.	Farmers' institutes.	Correspondence courses.	Agriculture in schools.	Miscellaneous specialists.
Alabama.....	\$3,703.83					\$1,981.34		\$50.00	\$801.49	\$144.79				\$1,941.03
Arizona.....	166.64								802.54					12,739.94
Arkansas.....							\$231.25		1,973.92					3,013.11
California.....							1,551.85							660.06
Colorado.....	233.29						3,551.38		799.26	582.12			\$349.68	1,514.23
Connecticut.....							3,436.65	570.58	331.06					
Delaware.....														
Florida.....	2,407.67													
Georgia.....	3,925.17	\$1,968.25				2,007.27			1,872.95	2,551.43				659.76
Idaho.....	3,117.91	3,117.91												
Illinois.....	7,573.22	4,829.71	\$2,130.86	\$1.06	\$11.50	2,022.44	2,968.65			2,432.49	\$28,576.43			11,548.73
Indiana.....	10,038.60	7,689.67				5,427.78	3,643.64					\$1,305.37	1,257.39	
Iowa.....	2,731.83	1,899.60	1,512.22			10,549.44	2,457.59				11,487.11	12,100.60		
Kansas.....	1,890.74	1,243.06					2,899.73	8,677.72	7,502.24					
Kentucky.....									5,391.79					
Louisiana.....														473.75
Maine.....							801.16				582.86			
Maryland.....	2,160.16	2,814.09												
Massachusetts.....	3,624.59	3,024.59		225.00			3,005.72	6,947.30	3,653.86	1,137.85		14,183.74		219.70
Michigan.....	3,558.61	7,195.91		1,033.03	1,259.63	1,613.11	3,596.55		4,982.59		9,282.57			
Minnesota.....	1,021.03	1,796.66	2,026.11				10,514.64	6,123.89	853.54	1,125.88	4,132.56			
Mississippi.....	2,276.67	2,276.67				2,359.21	2,979.15	2,082.05	2,736.20					
Missouri.....	7,660.40	4,024.16		3,296.15		1,734.86	2,713.51	6,971.61		1,382.27				836.80
Montana.....							2,490.03		1,450.00		7,200.00			
Nebraska.....	3,274.66	3,891.18				3,544.54	7,330.14		400.00					
Nevada.....														
New Hampshire.....	1,619.51	1,619.51			2,982.23		2,307.57							2,184.92
New Jersey.....	4,007.05	6,031.71		373.46										158.39
New Mexico.....							3,283.24			845.60		2,339.20		1,036.42
New York.....	8,554.57	4,914.83	5,930.20	4,972.25	3,282.06	500.00	7,497.50	614.39						
North Carolina.....	13,718.15	2,229.16		1,046.91		3,862.90	1,000.00	800.00	6,040.03					467.60
North Dakota.....							4,520.31		250.00					6,691.79
Ohio.....	3,947.51					3,433.90	5,484.00							
Oklahoma.....						2,239.99		670.62	500.00					
Oregon.....							6,663.53		4,092.22					9,387.82
Pennsylvania.....	2,784.06	4,097.03		2,660.49										
Rhode Island.....	1,333.95						2,791.07			1,457.40				
South Carolina.....	2,211.52	3,378.63	1,741.69	589.74										
South Dakota.....	199.38	1,534.91				1,635.03	3,544.14		2,703.38					

Total expenditures of funds from all sources for cooperative agricultural extension for the year ended June 30, 1917—Continued.

BY PROJECTS—Continued.

State.	Agronomy.	Horticulture.	Botany and plant pathology.	Entomology, apiculture, ornithology.	Forestry.	Agricultural engineering.	Farm management.	Rural organization.	Marketing.	Exhibits and fairs.	Farmers' institutes.	Correspondence courses.	Agriculture in schools.	Miscellaneous specialists.
Tennessee.....	\$5,298.52	\$1,292.50	\$102.21	\$211.50		\$701.33		\$12,656.30	\$2,810.39					
Texas.....			16,656.01			767.87	\$2,696.68					\$300.00		
Utah.....	2,432.29						2,399.38			\$666.97				
Vermont.....		7,073.44				1,008.58	2,630.17							
Virginia.....	2,775.71													
Washington.....	3,389.17	3,142.73									\$5,029.68	\$896.25		
West Virginia.....		3,092.66												
Wisconsin.....	3,923.14		2,406.85		\$2,023.08	5,199.13	2,448.37			155.69	941.46		97.50	
Wyoming.....														
Total, 1917.....	105,529.87	84,069.57	32,596.15	14,826.22	9,558.50	50,600.78	102,033.20	46,194.46	50,237.47	12,482.49	94,521.08	50,804.53	5,279.50	\$53,534.22
Total, 1916.....	77,859.05	79,745.13	14,014.12	8,510.74	3,638.84	36,680.32	88,469.26	39,447.36	20,493.57	12,650.06	93,815.11	30,866.67	16,931.65	61,596.02
1915.....	20,912.81	29,927.89	4,923.17	3,940.00	3,965.44	13,041.60	51,531.27	5,060.34	2,298.60	14,019.21	92,379.09	8,442.64	6,548.89	119,473.14

Number of counties with county agents and expenditures for county-agent work for the fiscal year ended June 30, 1917.

State.	Number of agricultural counties.	Number of counties with agent.				Total expenditures.	Salaries.	Travel.	Other expenses.
		July 1, 1914.	July 1, 1915.	July 1, 1916.	July 1, 1917.				
Alabama.....	67	67	67	65	62	\$103,466.82	\$96,427.03	\$6,126.69	\$913.10
Arizona.....	6	.....	3	6	7	9,782.27	6,342.63	2,524.04	915.60
Arkansas.....	75	45	52	53	61	116,127.54	110,880.88	5,219.97	26.69
California.....	45	4	11	13	17	66,129.06	32,355.89	24,610.53	9,162.64
Colorado.....	35	13	13	19	16	26,550.88	17,753.37	6,394.17	2,403.34
Connecticut.....	8	1	6	7	8	46,648.60	30,068.47	7,562.86	9,017.27
Delaware.....	3	.....	3	3	2	7,789.31	5,913.14	1,509.77	366.40
Florida.....	50	25	36	33	37	61,766.79	56,254.96	4,668.86	842.97
Georgia.....	150	80	81	83	117	146,281.78	135,209.09	10,753.84	318.85
Idaho.....	30	2	3	7	11	12,451.57	8,499.14	2,684.43	1,268.00
Illinois.....	102	14	18	20	22	135,690.07	100,549.11	17,126.98	18,013.98
Indiana.....	92	27	31	32	40	100,018.28	74,427.10	16,117.69	9,473.49
Iowa.....	99	9	11	16	26	35,133.05	33,211.44	1,921.62	.....
Kansas.....	105	9	39	56	53	57,700.12	39,821.63	17,198.08	680.41
Kentucky.....	120	28	39	47	45	97,564.77	92,222.42	5,242.70	99.65
Louisiana.....	64	41	43	43	42	86,094.78	74,626.41	11,373.76	94.61
Maine.....	16	.....	3	4	9	18,765.62	11,590.26	5,649.50	1,525.86
Maryland.....	23	8	13	16	23	42,508.11	40,886.03	949.97	672.11
Massachusetts.....	13	1	10	9	11	74,716.77	29,729.81	25,958.92	19,028.04
Michigan.....	84	11	17	22	30	57,649.77	53,811.18	1,973.44	1,865.15
Minnesota.....	86	27	23	19	16	52,495.37	37,460.70	7,885.54	7,149.13
Mississippi.....	80	48	49	44	53	71,154.70	63,832.62	6,057.40	1,264.68
Missouri.....	114	13	15	14	15	44,088.43	36,820.80	5,295.09	1,972.54
Montana.....	41	4	8	7	12	44,291.53	21,195.00	22,759.77	336.76
Nebraska.....	93	5	8	9	8	46,348.25	33,611.18	10,533.30	2,203.77
Nevada.....	15	.....	.....	.....	6	3,980.79	2,534.15	885.72	560.92
New Hampshire.....	10	1	5	8	9	27,782.99	16,590.73	5,986.97	5,205.29
New Jersey.....	19	4	7	11	10	41,934.33	26,891.51	7,895.41	7,147.41
New Mexico.....	26	.....	8	9	11	33,637.34	21,035.68	9,489.31	3,112.35
New York.....	57	25	29	36	41	180,830.36	110,363.86	35,854.07	34,612.43
North Carolina.....	100	51	64	65	69	114,492.21	108,859.90	4,827.55	804.76
North Dakota.....	51	17	15	15	17	57,188.97	40,890.22	15,880.90	417.85
Ohio.....	75	8	10	12	20	60,517.54	38,971.67	11,879.58	9,666.29
Oklahoma.....	77	40	56	59	62	106,050.60	95,372.78	11,039.36	238.46
Oregon.....	35	10	12	13	14	50,552.06	32,354.71	8,719.89	9,477.46
Pennsylvania.....	67	10	14	22	45	99,205.82	69,158.28	18,972.10	11,075.44
Rhode Island.....	5	.....	.....	4	4	2,771.85	2,445.65	289.39	36.81
South Carolina.....	44	43	43	42	40	79,401.14	75,840.70	3,500.70	59.74
South Dakota.....	66	3	5	11	13	33,436.38	24,874.57	3,562.99	4,998.82
Tennessee.....	96	36	38	48	57	84,682.65	78,904.78	5,616.75	161.12
Texas.....	250	98	99	90	92	175,714.35	159,575.16	15,326.05	813.14
Utah.....	28	8	10	8	15	27,164.04	16,895.31	9,394.78	873.95
Vermont.....	14	7	9	11	11	15,798.64	15,033.95	685.73	78.96
Virginia.....	100	53	55	51	53	92,307.24	85,150.53	6,810.36	346.35
Washington.....	37	7	10	13	22	53,572.59	31,198.41	12,812.20	9,561.93
West Virginia.....	55	13	27	29	45	66,886.27	56,157.69	9,486.81	1,241.77
Wisconsin.....	71	9	12	13	22	57,033.17	38,311.27	14,255.17	4,466.73
Wyoming.....	21	3	6	8	13	32,885.36	21,256.43	9,465.52	2,163.41
Total, 1917.....	2,920	1928	.....	.....	1,434	3,059,640.94	2,412,168.23	450,736.23	196,736.48
1916.....	.....	.....	.....	1,225	.....	2,411,539.81	1,908,951.25	338,156.81	164,431.75
1915.....	.....	1,136	.....	.....	.....	1,900,048.84	1,576,843.40	257,152.46	66,052.98

Number of counties with home-demonstration agents and expenditures for home-demonstration work for the fiscal year ended June 30, 1917.

State.	Num- of agri- cultural counties.	Number of counties with agent.				Expenditures for all home-demonstration work.			
		July 1, 1914.	July 1, 1915.	July 1, 1916.	July 1 1917.	Total ex- pendi- tures.	Salaries.	Travel.	Other expens- es.
Alabama.....	67	18	19	27	28	\$30,934.02	\$27,348.58	\$2,584.26	\$1,001.18
Arizona.....	6					1,135.65	600.00	482.60	53.05
Arkansas.....	75	15	20	31	47	38,262.12	35,395.10	2,685.98	181.04
California.....	45					5,020.81	2,649.92	2,032.27	338.62
Colorado.....	35			2		2,584.72	1,783.29	473.20	328.23
Connecticut.....	8				5	1,123.04	776.25	306.99	39.80
Delaware.....	3				1	2,498.29	1,750.00	422.85	325.44
Florida.....	50	24	27	28	35	40,051.90	34,982.66	5,068.29	.95
Georgia.....	152	29	48	45	57	53,472.04	47,652.35	5,538.54	281.15
Idaho.....	30					2,696.56	1,850.00	717.46	129.10
Illinois.....	102			1		11,428.47	9,292.34	219.20	1,916.93
Indiana.....	92					4,612.24	3,396.92	1,176.10	39.22
Iowa.....	99					16,872.25	15,517.65	987.33	367.27
Kansas.....	105					12,497.80	10,850.22	979.43	668.15
Kentucky.....	120	9	19	24	27	19,160.65	14,663.72	3,864.52	632.41
Louisiana.....	64	13	13	18	20	21,074.64	18,551.29	2,521.70	1.65
Maine.....	16					3,160.52	2,033.24	979.02	148.26
Maryland.....	23	5	6	10	13	11,338.26	8,088.34	1,977.88	1,272.04
Massachusetts.....	13			1	6	5,735.24	4,700.38	781.32	253.54
Michigan.....	82			1	1	6,671.16	3,921.25	2,019.39	730.52
Minnesota.....	86					7,371.99	5,177.50	1,937.81	256.68
Mississippi.....	80	33	33	32	49	48,356.91	41,793.08	5,073.22	1,490.61
Missouri.....	114					9,463.00	5,385.06	1,779.67	2,298.27
Montana.....	41					5,908.63	2,791.68	1,600.00	1,516.95
Nebraska.....	93				2	9,623.13	7,547.11	1,497.24	578.78
Nevada.....	15			1		1,631.31	907.63	512.21	211.47
New Hampshire.....	10				2	3,825.62	3,149.92	626.82	48.88
New Jersey.....	19			1		4,088.93	2,570.55	853.92	664.46
New Mexico.....	26				1	2,766.41	1,595.28	988.95	182.18
New York.....	57				3	13,017.80	11,064.56	1,137.35	815.89
North Carolina.....	100	27	34	44	48	67,539.26	63,660.02	3,307.00	572.24
North Dakota.....	51				2	7,166.73	5,471.16	1,460.73	254.84
Ohio.....	75			1		18,594.19	14,161.66	4,200.94	231.59
Oklahoma.....	77	19	24	22	23	27,085.63	22,573.92	3,819.86	691.85
Oregon.....	35					3,652.84	1,920.00	1,236.70	496.14
Pennsylvania.....	67			1		7,911.37	5,227.45	747.65	1,936.27
Rhode Island.....	5					1,545.20	1,200.00	303.15	42.05
South Carolina.....	44	21	24	31	36	52,416.90	38,566.65	13,524.02	326.23
South Dakota.....	66					1,446.29	958.33	339.14	148.82
Tennessee.....	96	18	24	31	49	52,151.34	44,714.00	7,350.66	86.68
Texas.....	250	26	27	38	31	29,579.77	23,282.35	6,062.01	235.41
Utah.....	28			2	2	5,743.60	4,675.71	942.17	125.72
Vermont.....	14					3,047.75	1,757.50	635.67	654.58
Virginia.....	100	17	22	25	38	37,344.18	30,201.51	6,330.87	811.80
Washington.....	37					3,997.34	2,700.00	1,006.05	291.29
West Virginia.....	55	5	10	12	12	14,927.66	10,116.30	3,871.48	939.88
Wisconsin.....	71					8,323.73	6,495.00	1,759.78	68.95
Wyoming.....	21					2,822.00	1,998.00	771.88	52.12
Total, 1917.....	2,920	1 279			537	741,679.89	607,465.43	109,495.28	24,719.18
1916.....				430		519,866.99	420,420.04	79,330.84	20,116.11
1915.....			350						

¹ Total for 1914.

Number of persons on extension staffs classified according to the time devoted to agricultural extension work for the fiscal year ended June 30, 1917.

State.	Extension staff.								Also connected with experiment station.				Also connected with college teaching.			
	Total.		Full time.		More than half time.		Less than half time.		More than half time.		Less than half time.		More than half time.		Less than half time.	
	M.	W.	M.	W.	M.	W.	M.	W.	M.	W.	M.	W.	M.	W.	M.	W.
Alabama.....	104	42	93	39	2	2	9	1	2		7				3	
Arizona.....	10	1	9	1			1				3					
Arkansas.....	121	61	107	60			14	1			14	1			14	1
California.....	98	3	36	2			62	1			45				45	
Colorado.....	24	3	17	3	2		5				5				5	
Connecticut.....	19	11	16	8	1	3	2		1						2	2
Delaware.....	10	3	4	2			6	1			4				5	
Florida.....	57	44	44	32	9	9	4	3							1	
Georgia.....	126	66	126	66												
Idaho.....	27	6	16	2			11	4			1				4	1
Illinois.....	37	9	32	7	2		3	2			3			2		2
Indiana.....	145	35	72	7	1		72	28					1		3	
Iowa.....	111	43	57	11	3		51	32								
Kansas.....	45	11	45	11					1				1			
Kentucky.....	124	64	62	32	62	32										
Louisiana.....	74	26	72	26	1		1		1							
Maine.....	12	2	11	2	1											
Maryland.....	42	34	36	34			6								5	
Massachusetts.....	34	14	27	14			7								7	
Michigan.....	45	6	45	6									1			
Minnesota.....	60	12	32	4			28	8								
Mississippi.....	84	58	82	38	2	12		8					2			
Missouri.....	46	6	43	6	3				3							
Montana.....	24	4	24	4											2	
Nebraska.....	40	18	26	12	1	1	13	5			10				11	1
Nevada.....	10	6	6	4			4	2			2				3	1
New Hampshire.....	33	4	18	3	1		14	1	1		8				14	1
New Jersey.....	30	7	28	7	1		1				1					
New Mexico.....	41	13	36	13			5				5				5	
New York.....	89	9	73	7	1		15	2					1		15	2
North Carolina.....	115	63	106	43	8	7	1	13	2		1				1	
North Dakota.....	38	6	27	3	2		9	3			5					
Ohio.....	114	24	48	11	6	3	60	10			4	1			11	3
Oklahoma.....	84	38	81	37			3	1								
Oregon.....	54	18	35	16			19	2			14				14	
Pennsylvania.....	49	3	49	3												
Rhode Island.....	6	1		1	1		5				2				3	
South Carolina.....	74	48	67	47		1	7				2				6	
South Dakota.....	26	9	20	1	1	2	5	6					4			
Tennessee.....	88	70	82	70			6				6				6	
Texas.....	160	46	160	46												
Utah.....	31	5	26	5	2		3				1		1		2	
Vermont.....	24	2	15	1			9	1			9				9	
Virginia.....	91	126	64	19	21	42	6	65							1	
Washington.....	41	10	41	10										1		
West Virginia.....	138	18	77	5	51	12	10	1	3		6		3		6	
Wisconsin.....	103	5	28	4	24	1	51	15			44		10	1	41	
Wyoming.....	25	4	17	2			8	2			4				5	
Total, 1917.....	2,983	1,117	2,238	787	209	127	536	203	29		206	2	26	2	249	14
1916.....	2,266	754	1,686	515	108	100	472	139	30		199	7	33	19	226	17

Agricultural extension publications for the fiscal year ended June 30, 1917.

State.	Number of publications issued.	Number of pages issued.	Number on mailing list.	Total cost.
Alabama.....	28	145	28,000	\$2,613.16
Arizona.....	90	243	3,000	1,082.95
Arkansas.....	17	121	10,000	3,010.86
California.....			35,790	1,318.70
Colorado.....	13	256	3,500	1,824.20
Connecticut.....	11	140	9,000	1,518.59
Delaware.....			7,000	9.50
Florida.....	6	207	14,000	1,648.34
Georgia.....	51	852	30,000	5,661.30
Idaho.....	9	68	1,500	306.65
Illinois.....	10	182	100,000	2,636.23
Indiana.....	28	286	443	1,757.11
Iowa.....	105	1,000	2,500	15,316.76
Kansas.....	9	170	12,000	87.51
Kentucky.....	43	303	5,600	1,268.67
Louisiana.....	6	116	9,000	1,902.64
Maine.....	61	316	5,000	421.13
Maryland.....	28	150	5,000	2,819.00
Massachusetts.....	74	417	700	3,706.41
Michigan.....	11	108	15,000	2,156.59
Minnesota.....	41	445	57,500	48.04
Mississippi.....	12	118	12,000	3,228.23
Missouri.....	15	218	12,969	4,662.87
Montana.....	9	130		553.09
Nebraska.....	19	164	32,055	1,526.87
Nevada.....	13	104	7,000	938.24
New Hampshire.....	18	141	11,000	1,433.14
New Jersey.....	4	176	10,000	1,397.49
New Mexico.....	23	356	10,000	1,547.96
New York.....	63	1,272	88,000	9,384.89
North Carolina.....	38	430	15,000	4,707.50
North Dakota.....	8	136	3,000	5,484.80
Ohio.....	81	724	44,000	7,788.17
Oklahoma.....	26	181	1,200	2,702.69
Oregon.....	95	678	25,000	5,501.69
Pennsylvania.....	18	289	35,000	6,531.24
Rhode Island.....	2	16	1,200	71.25
South Carolina.....	12	290	1,200	3,327.83
South Dakota.....				18.24
Tennessee.....	24	157	25,000	4,291.74
Texas.....	40	350	8,123	6,689.01
Utah.....	34	361		1,003.54
Vermont.....	2	32	12,000	416.04
Virginia.....	9	126	5,000	1,642.27
Washington.....	79	168	16,000	1,643.36
West Virginia.....	67	400	27,229	2,246.62
Wisconsin.....	34	257	30,000	1,749.38
Wyoming.....	86	304	12,180	2,045.38
Total, 1917.....	1,472	13,153	798,689	133,647.87
1916.....	804	9,339	1,023,828	99,779.68
1915.....	819	8,279	967,426	72,090.72

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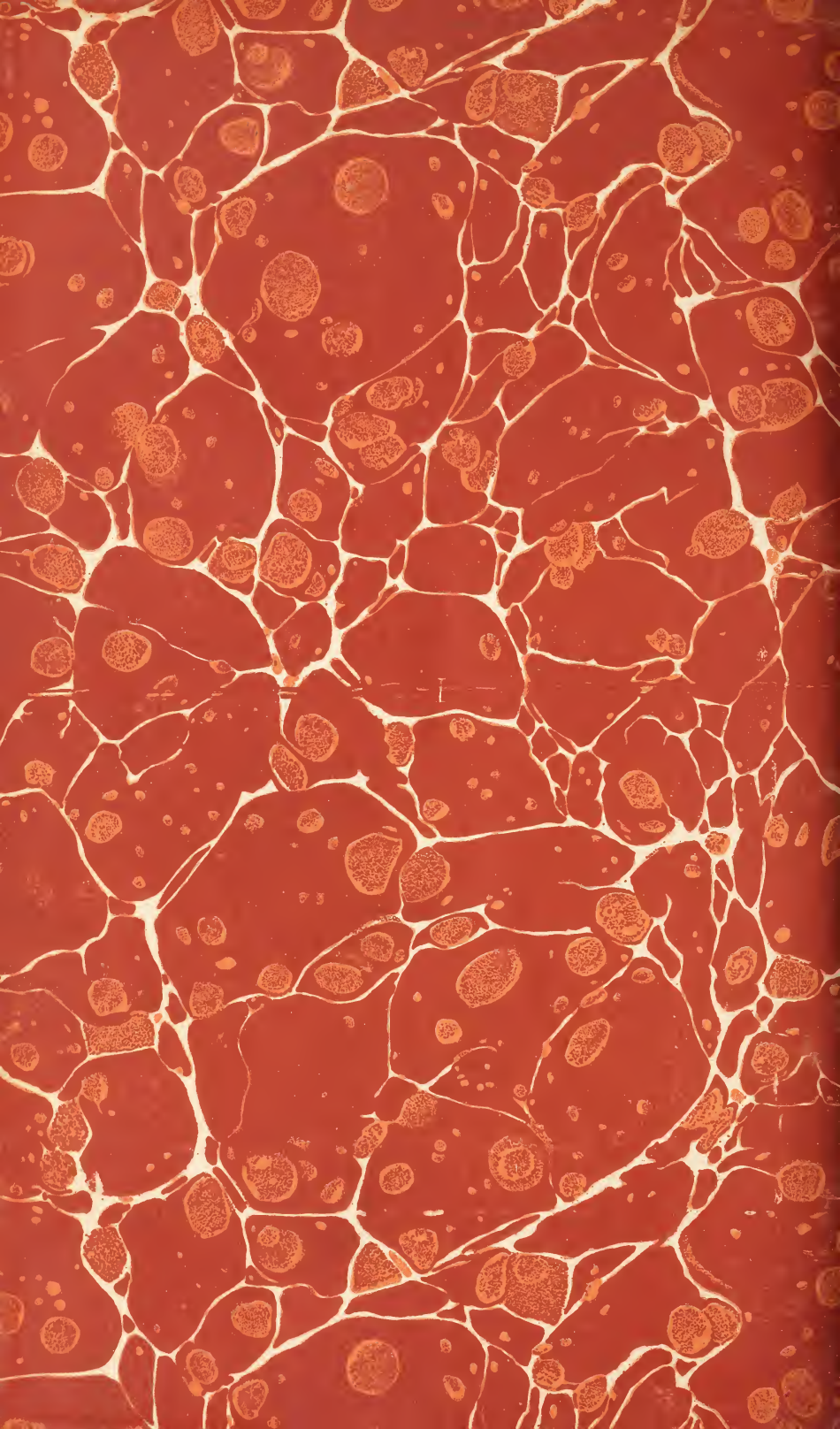
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